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Economic nature of the cooperative association

Richard Phillips
Iowa State College

NOTE TO USERS

ECONOMIC NATURE OF THE COOPERATIVE ASSOCIATION

BY

Richard Phillips

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Signature was redacted for privacy.

In Charge of Major Work

Signature was redacted for privacy.

Head of Major Department

Signature was redacted for privacy.

Dean of Graduate College

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I. INTRODUCTION

Business activity conducted through cooperative associations represents an important segment of the total national economic activity in the United States and in most of the rest of the free world. Although particularily suited to industries characterized by small independent business enterprises such as agriculture, cooperative associations among large manufacturing and processing companies, wholesale concerns, railroads and other relatively large corporations have been successfully operated for many years. Cooperative associations of consumers are common, especially in England and other European countries. Special enabling statutes for firms or households interested in forming a cooperative association are available in all forty-eight states in this country. Publicly supported research and educational programs of direct benefit to those taking part in cooperative activity are carried on in this and other countries.

Both the form of organization and the method of operation vary considerably from one cooperative association to another. State enabling acts vary widely; in many states cooperatives are organized and operated under several laws, no two of which are identical. No two associations under the same law are organized and operated identically. Cooperative associations may be local or regional, centralized

or federated, stock or non-stock, and may be engaged in almost all imaginable kinds of business activity. Some operate on a pool and others on a purchase and sale basis. They are financed by many different methods. Yet all have many distinguishing characteristics in common. The basic economic structure is always the same. The basic multilateral economic relationships which exist among the firms or households participating in the joint activity are common to all cooperative associations.

The basic economic nature characteristic of all cooperative associations is the subject to which this thesis is addressed.

A. Statement of the Problem

The importance of an adequately developed concept of the basic economic nature of the cooperative association is emphasized by Professor Robotka:

> Since cooperative activity is essentially economic activity and the cooperative is essentially an economic institution seeking economic ends, the basic criteria must be provided by economics. Unless it succeeds in attaining its economic objectives, its implications from ethical, legal or other points of view have little more than academic interest. . . . the economic considerations are basic; decisions with respect to the others are sound to the extent that they are consistent with the peculiar economic nature, aims and purposes of cooperation.[1]

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[1] Robotka, Frank. Lego-Economic Implications of Cooperation. In American Cooperation; 1946. p. 522-533. American Institute of Cooperation. Washington, D. C. 1946. p. 525.

The economic theory of cooperation has lagged considerably behind practical cooperative development. Cooperative associations have developed to their present state structurally largely by trial and error. Historically many of the errors have been very costly. The path is strewn with the wreckage of unsuccessful attempts at business cooperation among sovereign economic units. Laws permitting such organization were slow to develop and even today represent "modifications" in ordinary corporate laws rather than being "tailor-made" to recognize the nature and suit the needs of the cooperative association. This is not surprising since until recently little had been done toward developing an adequate economic concept of the cooperative association.

One still finds the economic theory of cooperation fragmentary and incomplete. Excepting Emelianoff and Robotka, authors concerned with analyses dealing specifically with the cooperative association have largely used the institutional rather than the theoretical approach. Too often the applied economist in this field has not even concerned himself with the basic economic nature of the cooperative, but has made his point of departure what he has somewhat mistakenly called the "basic cooperative principles". The theoretical economist, on the other hand, when he has dealt with economic structures at all, has assumed that the cooperative as such can adequately be analyzed with the models developed

for and adapted to the economic firm. As Emelianoff[1] has demonstrated, this is a faulty assumption and one which leads to serious inaccuracies and inconsistencies. There is a need, therefore, to develop a more adequate analysis of the basic economic nature of the cooperative association and similar economic structures. The work of Emelianoff and Robotka and the contemporary general economic theory of the firm provide the principal foundations for doing so.

B. Method of Analysis

The analysis used is primarily that of deductive economic logic. Mathematical analysis is not employed except by diagram to illustrate concepts which represent the most pronounced departures from the existing economic literature. The intention is that of tool building rather than tool applying; consequently empirical analysis is not involved.

Following a review of the literature dealing specifically with the subject of the thesis, the fundamental structure in the cooperative association is developed. Next the economic relationships arising in the cooperative association are examined. Then the conditions for profit maximization in firms participating in a joint activity are studied in some

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[1]Emelianoff, Ivan V. Economic Theory of Cooperation. Ivan V. Emelianoff. Washington, D. C. 1942.

detail. Under dynamic conditions stability as well as efficiency objectives are considered. Finally a few important applications of the concept of the nature of the cooperative association are indicated.

The analysis applies directly to all types of cooperatives which are organized by firms for production purposes. Cooperatives of households are exactly the same in structure, so that by substituting "consumption" for "production", "household" for "firm" and "satisfactions" for "profits" the analysis is applicable for the most part to cooperative associations of consumers also.

C. Objectives

The problem to which the author has addressed himself is threefold. There is, first of all, need for a synthesis of the best that has been written concerning the economic nature of the cooperative. Secondly there is a need to apply the tools and models of theoretical economic analysis to the firms which participate in the cooperative association. This means that at some points these tools and models will need to be sharpened and expanded. In the third place a reasonably complete and consistent theoretical framework of the economic nature of the cooperative needs to be laid down, and the application of the concept to practical conditions indicated.

The companion problem, which is of greater magnitude, is

outside the scope of this study. That problem is the development of the economic theory of the welfare aspects of cooperative associations in a free enterprise economy. This is a task which remains to be done. With the economic nature of the cooperative association under dynamic conditions, the tools of monopolistic competition, and modern welfare economics as the basis, the development of such an economic concept is the next logical step.

Perhaps four specific objectives have stood foremost in the mind of the author in the preparation of this thesis:

1. It is hoped that the teacher, both in the classroom and in extension work, will find the basic framework and concepts useful to him in making business cooperation a more teachable discipline.

2. It is hoped that the general economist will find his interests aroused to the extent that he will test, modify and expand the concepts presented.

3. It is hoped that practical cooperative leaders will find food for thought and guidance in the following pages.

4. It is hoped that, rather than serving as any final answer, the present attempt will serve as building stones for further attention and research, not only by the economist, but by students of cooperation generally--sociologists, attorneys, accountants, educators, and those of other disciplines alike.

II. LITERATURE ON THE ECONOMIC NATURE OF THE COOPERATIVE ASSOCIATION

Cooperative literature is voluminous, dating back to considerably before 1900, and continuing up until the present time. Very few authors writing about cooperatives have concerned themselves with their economic nature, however. As one goes through the literature prior to 1940, he gets the impression that there are those concerned with theoretical economics and those concerned with cooperation, but that "never the twain shall meet".

Predominant among cooperative writers are those presenting socio-reformistic interpretations of the cooperative problem. Emelianoff has presented an excellent statement regarding this school of thought:

> The socio-reformistic approach to the cooperative problem has always been--especially in Europe--decisively predominant among the interpreters of cooperation and has crystallized out in the course of a century in a sort of orthodoxy. Originated supposedly in the philosophy of Robert Owen and Charles Fourier, greatly strengthened by the authority of J. S. Mill, jealously nurtured and guarded by the Christian Socialists in England and by the so-called "School of Nimes" in France, this traditional doctrine has gradually dogmatized into a set of kindergarten-truths or "Principles of Cooperation".[1]

The socio-reformistic literature is only of passing interest here since it is largely emotionally guided, is philosophical rather than scientific, and has little relation

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[1] Emelianoff. op. cit., p. 3.

to the practical cooperative world of today. It has continued, however, from such early leaders as Robert Owen, Beatrice Porter-Webb and Sidney Webb, G. J. Holyoake, and Charles Fourier to the so-called "consumer cooperative philosophy" of today as exemplified by Murray Lincoln,[1] E. R. Bowen,[2] J. P. Warbasse,[3] and M. M. Coady.[4]

In addition to that of a socio-reformist nature there has also been a wealth of descriptive literature on cooperation, particularly in the United States and Canda, and in the Scandinavian countries. Much of this has had to do particularly with agricultural cooperatives.

> Descriptive publications represent the important and most valuable part of the literature on cooperation. The American literature on the subject is concerned mainly with the aspects of business efficiency of cooperative organization and is strongly lacking in any analytical attempts.[5]

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[1] See Lincoln, Murray D. Producer-Consumer Cooperative Relationship. In American Cooperation; 1936. p. 25-36. American Institute of Cooperation. Washington, D. C. 1936.

[2] See Bowen, E. R. The Aims and Objectives of the Consumers Cooperative Movement. In American Cooperation; 1937. p. 127-140. American Institute of Cooperation. Washington, D. C. 1937.

[3] See Warbasse, J. P. The Cooperative Way. Barnes and Noble, Inc. New York. 1946.

[4] See Coady, M. M. The Spiritual Significance of Economic Cooperation. In American Cooperation; 1946. p. 68-76. American Institute of Cooperation. Washington, D. C. 1946.

[5] Emelianoff. op. cit., p. 12.

Representative of this literature concerning business efficiency of cooperatives and other descriptive material are most of the publications of the cooperative Research and Service Division of the Farm Credit Administration, Land Grant College bulletins concerning cooperatives, as well as college text books such as those authored by Coulter,[1] Powell,[2] Jesness,[3] McKay and Lane,[4] Filley,[5] Cornish,[6] White,[7] and Bakken and Schaars.[8] As important as these contributions are, however, they offer little or no attempt to define the economic nature of the cooperative.

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[1]Coulter, J. L. Cooperation among Farmers. Sturgis and Walton Co. New York. 1911.

[2]Powell, G. Harold. Cooperation in Agriculture. Macmillan Co. New York. 1913.

[3]Jesness, O. B. The Cooperative Marketing of Farm Products. J. P. Lippincott Co. Philadelphia. 1923.

[4]McKay, A. W. and Lane, C. H. Practical Cooperative Marketing. John Wiley and Sons, Inc. New York. 1928.

[5]Filley, H. C. Cooperation in Agriculture. John Wiley and Sons, Inc. New York. 1929.

[6]Cornish, Newel H. Cooperative Marketing of Agricultural Products. D. Appleton and Co. New York. 1928.

[7]White, H. F. Cooperative Marketing of Farm Products in the United States. John Brown University Press. Siloam Springs, Ark. 1937.

[8]Bakken, Henry H. and Schaars, Marvin A. The Economics of Cooperative Marketing. McGraw-Hill Book Co. New York. 1937.

A. Pre-Emelianoff Writings on the Economic Nature

The analyses which have been made dealing with the area of this specific problem fall into separate classes, (1) institutional analyses and (2) theoretical analyses.[1]

Several American agricultural economists have made institutional analyses concerning the economic nature of the cooperative association. In 1917 Hibbard wrote,

> . . .they [cooperators] have banded together for the common purpose of doing for themselves jointly something which each separately could not do as economically, and which they do not choose to leave to an outside, or independent, agency.[2]

Powell stated three years later,

> A co-operative association is one in which the members form an agency through which they conduct their own business for their greatest mutual advantage. . . .
> The foundation of the co-operative association is men and, preferably, each member has an equal voice in directing its operations.[3]

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[1]For a distinction between these two approaches see Holman, Paul T. The Institutional School. In Encyclopedia of the Social Sciences. Vol. 5. p. 387-392. The Macmillan Co. New York. 1931. He says (p. 388) the Institutional Economist believes "that social science must deal with real human beings, not with rationalized human nature, with the run of facts rather than a normalized picture of them". Emelianoff (op. cit.) apparently completely overlooked the institutional analyses dealing with this problem in his otherwise excellent review of the literature (p. 1-32).

[2]Hibbard, B. H. Agricultural Cooperation. Wisc. Agr. Exp. Sta. Bul. 238. Madison. 1917. p. 4.

[3]Powell, G. Harold. Fundamental Principles of Co-operation in Agriculture. Calif. Agr. Exp. Sta. Cir. 222. Berkeley. 1920. p. 1-2.

Most of J. D. Black's analysis has concerned the role and possibilities of agricultural cooperatives but he has constantly looked on the cooperative as a horizontal combination of coordinate units, usually as an essential for achieving vertical integration either backward or forward in the marketing system.[1] Regarding the coordinated activities of the cooperative members, Black stated that they have agreed in effect to cooperate on these specific functions while continuing to compete on others.[2]

The early analysis of Professor Robotka is also largely institutionally oriented. In 1924 he stated,

> When farmers establish cooperative business organizations the purpose usually is not to make profits as business men dealing with the public, but to make their farming operations more profitable.[3]

Ten years later he listed six qualifications for the true cooperative association:

> 1. Membership must be limited to producers (or consumers) of the products or commodities handled by the cooperative who are in sympathy with the purpose of the organization and who are willing to pledge their patronage to it, and to assume an equitable share of the financial burden.

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[1] Black, J. D. Production Economics. Henry Holt. New York. 1926. p. 891

[2] Ibid. p. 866. Also Black, J. D. Economic Possibilities of Cooperation. In American Cooperation; 1925. Vol. 1. p. 85-91. American Institute of Cooperation. Washington, D. C. 1925.

[3] Robotka, Frank. Cooperation under Iowa Cooperative Laws. Iowa Agr. Exp. Sta. Cir. 95. Ames. 1924. p. 4.

> 2. Membership shall be contingent on personal and not on capital qualifications.
> 3. Only qualified members as such shall have a voice in the affairs of the organization. Capital as such shall have no voice.
> 4. Business is to be done with members only and for their mutual benefit. (Non-members should be given liberal opportunity to qualify as members.)
> 5. Capital is to receive not more than a reasonable rate of interest, and reserves in excess of costs and interests are to accrue to the members according to patronage.
> 6. Since members share in gains according to patronage, and since capital is not to share in profits, risks must be borne by members according to patronage or some other equitable basis.[1]

In the same bulletin Robotka wrote of the patronage refund:

> When a patronage dividend is paid, it may, in fact, include all three elements, namely: final payment, if the price advanced at time of delivery was not the full competitive price; the profit which the dealer would normally receive as a reward for his services as organizer and manager; and savings resulting from marketing in a more economical manner.[2]

By way of setting up his measuring stick for the cooperative creameries in practice, Stitts wrote:

> The purpose of cooperative associations in general is to maximize net returns to members. . . .the relationship existing between the association and its patrons. . .in four fundamental aspects. . .are (1) control; (2) financing; (3) patronage; and (4) participation.[3]

Although cooperative manager rather than economist by profession, Quentin Reynolds arrives at the following sound

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[1]Robotka, Frank. Membership Problems and Relations in Iowa Farm Elevators. Iowa Agr. Exp. Sta. Bul. 321. Ames. 1934. p. 168-169.

[2]Ibid. p. 183-184.

[3]Stitts, T. G. Extent to which Cooperative Creameries

conclusion, "The [purchasing] cooperative is as much the purchasing department of the members it serves as is the purchasing department of any corporation."[1]

Of those making contributions to an understanding of the economic nature of cooperative associations from the point of view of institutional analysis, Dr. Nourse probably ranks first. He recognized the need for such an understanding in 1922 when he said, "Taken by and large cooperators are long on practice and short on theory."[2] Nourse went on to say,

> . . .it is possible to organize an economic system from the standpoint and for the benefit of either (1) the capitalist, (2) the wage worker, or (3) the patron. The capital stock corporation does the first; labor co-partnership has at times attempted to do the second; and agricultural cooperation is gradually perfecting methods for doing the third.[3]

Nourse has also written,

> In theory, the cooperative association does not go into the market place to compete with other companies for a share of the business, but represents the coming together of some selected group

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Are Truly Cooperative. In American Cooperation; 1936. p. 126-138. American Institute of Cooperation. Washington, D. C. 1936. p. 131-132.

[1]Reynolds, Quentin. Ultimate Objectives of Farm Purchasing Cooperatives. In American Cooperation; 1939. p. 674-677. American Institute of Cooperation. Washington, D. C. 1936. p. 674.

[2]Nourse, Edwin G. The Economic Philosophy of Cooperation. American Economic Review. 12:557-597. 1922. p. 557.

[3]Nourse, Edwin G. The Legal Status of Agricultural Cooperation. The Macmillan Co. New York. 1927. p. 21. As will be pointed out later, however, there is serious danger of being mislead by this analysis.

> to set up a mutual agency for rendering a particular service in common.[1]

And elsewhere he has stated:

> The co-operative movement is as old as the Industrial Revolution. . . .Three fundamentals are generally regarded as determining its distinctive character: (1) It seeks to render "service at cost" to its members rather than to profit from business with the general public. The group service set-up is regarded as a means of securing maximum efficiency with a minimum of waste. (2) It insists that financial returns be distributed to the members as producers after deducting only the competitive rate of interest to capital and wages and salaries to workers. (3) It holds to democratic control by all the participants in the business.[2]

The following quotation, also from Nourse, is even more enlightening as to the economic structure of cooperatives:

> . . .three outstanding characteristics by which the cooperative association differs from the ordinary commercial company. In the first place, it contemplates a group of persons engaged in a common economic enterprise who associate themselves together to maintain a joint agency which shall render service to all these business associates on a mutual or cost basis. . . .
>
> Second, the phrase "not conducted for profit" is one that has been much misunderstood. . . . It does not mean that the members of a co-operative association do not expect to receive economic benefit from its operations. . .it does mean that these benefits, even though measurable in pecuniary terms, shall accrue to participating members to enhance the return from their own operations as producers, rather than going as profits to those persons who have furnished capital to the joint enterprise. . . .

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[1] Ibid., p. 278.

[2] Nourse, Edwin G. The Philosophy of Cooperative

> In the third place. . . . On the theory that the contribution of capital should be regarded as an obligation of each member in proportion to the use which he makes of the facilities of the association, they have treated capital as loan funds to be paid for at the market rate, or in some instances, even below that rate.[1]

And finally Dr. Nourse has written,

> Hence a truly cooperative organization is one which consists only of participating members each of whom makes his individual business part of the joint business of the society [i.e., cooperative].[2]

This statement, of course, has definite implications concerning the economic nature of the cooperative association as it is, and had the last part of his sentence read vice versa (i.e., ". . .members, the business of the cooperative representing the sum of a part of each of the individual businesses of its members") he would have even more nearly anticipated the contributions of Emelianoff.[3]

General theoretical economists have made little or no contribution to an understanding of the economic nature of the cooperative association. They have looked at them simply as a special kind of corporation, covered quite adequately by the general theory of the firm. Even Boulding, although more

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Marketing. Pan American Union, Division of Agricultural Cooperation. Series on Cooperatives. No. 1. Washington, D. C. 1936. p. 2.

[1]Nourse. Legal Status. . . . pp. 80-82.

[2]Nourse. Economic Philosophy. . . . pp. 587-588.

[3]Emelianoff. op. cit.

aware than most theorists of the nature of the cooperative, has written:

> Through all these many forms of organization one principle holds: Profits, the difference between the value of outputs and the value of inputs, belong to the owners of a business in proportion to the share which they own. This principle applies even to another form of business organization--the cooperative society--which has risen into importance in the past hundred years and which may be of even greater importance in the future. A cooperative society is a business owned by the people who purchase from it, or who sell to it, in the proportion of the amount of their purchases or sales. . . .A cooperative society may be defined as a corporation which is financed entirely by fixed-interest securities ("bonds") and in which the ownership resides in the people who buy from it or sell to it. Its profits, consequently, also belong to the people who buy from it or sell to it, in proportion to the amount which they have bought or sold.[1]

In his book Emelianoff presented a review of the theoretical contributions of European economists to the understanding of the nature of the cooperative association.[2] Apparently the major contributions were made shortly after 1900 by Italian economists who were followers of Maffeo Pontaleoni, particularly Ghino Valenti and Mariano Mariani, and by Robert Liefmann in 1923.[3] As interpreted by Emelianoff,

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[1]Boulding, Kenneth E. Economic Analysis. Rev. ed. Harper and Bros. New York. 1948. p. 444-445.

[2]Emelianoff. op. cit., p. 15-26.

[3]Ibid. Emelianoff has mentioned the writings of others also, including those of Fuchs, Robbeno, Cobbi, Mancini, Vivante, Bohelli, Manura, and Bolaffio. These writings appear to contribute little, however, to the understanding of the

however, Valenti's analysis has to do primarily with the economic role of cooperatives rather than their nature. His definition of the cooperative is in fact in terms of its role.

> A cooperative association is an economic institution which within the existing system of free competition aims to correct wholly or partly the natural imperfections of the distribution of wealth.[1]

Mariani, on the other hand, while also concerned with their economic role, was quoted as concluding the following in regard to the economic nature of cooperative associations:

> A cooperative association is a voluntary association of the purchasers or sellers of labor and of other goods with the aim to improve the purchasers' and sellers' prices, and achieving it by an organization of their own enterprise respectively for buying or for selling.[2]

As discussed by Emelianoff, the contributions of the noted German economist, Liefmann, are even more important. His definition of the cooperative is quoted as,

> The cooperatives are the economies (Wirtschaften), which endeavor through a common business establishment to further or to complete acquisitive or consuming activities of their members.[3]

Leifmann believes further that the cooperative is a special economic form which is "essentially different from enterprise".[4]

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economic nature of the cooperative, and in some cases are misleading because of their orientation to labor co-partnerships, which are structurally different from cooperative associations.

[1] Ibid., p. 18.

[2] Ibid., p. 21.

[3] Ibid., p. 26.

[4] Ibid.

He has expanded this thought in the following passage quoted by Emelianoff:

> It is important to state in the interests of better understanding of the cooperatives, that they belong to a different sphere from the forms guided by the individualistic motives of getting profit. We should not, therefore, consider them as a variety of collective enterprise. . . .
>
> Finally, since the cooperative is inherently furthering or completing the economic activities of its members, all the members of cooperative associations necessarily participate in the economic work of the association.[1]

B. The Contributions of Emelianoff

The outstanding contribution of the literature relative to the economic nature of the cooperative association is Emelianoff's "Economic Theory of Cooperation".[2] Addressing himself specifically to Pattee's question,

> I wanted to find out just what we have got to do to be entitled to be considered cooperative. . . .I am wondering if thought along this line has gone far enough to enable us to set up a definition that is fixed and standard and can be applied with exactness. . . .[3]

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[1] Ibid., p. 26.

[2] Ibid. It is evident from the references by the author in Russian cited in his bibliography (p. 258-259) that Emelianoff had given a good deal of thought and study to this matter as early as 1924.

[3] Pattee, Richard. Conference on Tests of Cooperation; E. G. Nourse, Leader. In American Cooperation; 1925. Vol. 1. p. 151-182. American Institute of Cooperation. Washington, D. C. 1925. p. 165.

Emelianoff used the tools of theoretical economic analysis to provide the answer, which he has stated as follows:

> . . .the cooperative represents the associated economic units in their functioning and not their association as a separate economic entity; an association or aggregate is functioning only as a branch or part of associated economic units; in that respect it is perfectly identical with the special departments or branches of single economic units.[1]

He drew an analogy to a flock of birds. The cooperative

> . . .does not acquire or spend; just as a flock of birds by itself does not "fly". As a flock is only a group of flying birds, this "stock corporation" is a group of acquiring (enterprises) or spending (households) economic units.[2]

1. The analysis used

> It is essential that the student of cooperative organizations makes a clear separation of the concept (1) of establishment as a producing unit [plant] from that (2) of enterprise as an acquisitive economic unit [firm].[3]

> If every existing cooperative association is an organization of economic units (enterprises or households) i.e., if it is composed of such economic units, we are compelled to recognize that the cooperative is a derived economic formation.[4]

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[1] Emelianoff. op. cit., p. 249.

[2] Ibid., p. 159.

[3] Ibid., p. 164.

[4] Ibid., p. 91.

He points out that economic integration can take place (a) through expansion of existing individual economic units, (b) through fusion or consolidation, or (c) through the coordination of activities of existing economic units.

> . . .we need not go into detailed discussion of the first of these lines of integration since it can not be expected that a cooperative organization, being a derived form of an economic unit, can find any explanation in the process of growth of single economic units. . .
>
> Fusion as a process of economic integration means a complete assimilation by a newly derived economic body of the economic ingredients involved. These ingredients in the process of fusion lose their independence and their economic individuality. They cease to exist as economic entities. . . .When the well-known independent stock companies engaged in the manufacture of harvesting machines (McCormick, Deering, Milwaukee companies and some others) were fused into the International Harvester Company of America about two decades ago, they were completely absorbed by the gigantic trust and as separate enterprises have entirely disappeared; yet their factories have continued to work for a long time, probably without any visible changes and even their individual trade marks are still in use.[1]

Emelianoff also pointed out cases of partial fusion such as the various "combines" brought about by a fusion of common stock, but stated:

> All the derived economic organizations born in the processes of partial fusion remain distinctly either economic units or their modifications. The enterprises partially fused continue to be acquisitive forms; the "combines" a specific product of partial fusion--are without exception profit-getting economic bodies.[2]

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[1] Emelianoff. op. cit., p. 92-93.

[2] Ibid., p. 96.

> Coordination, as a way of economic integration, is not only radically different from fusion, but from the structural point of view is diametrically opposite to it. For. . .every coordination is intended only to achieve necessary adjustments of functioning of the participants without any encroachments upon their individuality or their independence. Fusion creates new economic units, while coordination aims only to harmonize the economic activities of existing economic individuals. . . .The product of economic fusion thus is an economic unit with an economic entity of its own, while the outcome of the coordinative process is an aggregate of coordinated economic bodies, a plurality of economic entities of its ingredients, but without any independent entity of its own.[1]

It was pointed out further that these aggregates may be distinguished from a structural point of view into (1) aggregates of economic fractions and (2) aggregates of economic units--acquisitive (enterprises) or spending (households).

> The economic fractions that are susceptible to coordination into aggregates are exclusively human fractions (renters, creditors, wage earners, salaried groups, entrepreneurial fractions, etc.)[2]

General farm organizations, Chambers of Commerce, professional societies, automobile clubs and trade unions are examples of aggregates of economic fractions as Emelianoff used the concept.

> The conception of an aggregate of economic units is a strangely difficult concept. It can not be comprehended precisely unless it is clearly understood, that an aggregate of economic units

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[1] Ibid., p. 97-98.

[2] Ibid., p. 99.

> is not the independent economic unit but the group of functioning economic units--acquisitive (enterprises) or spending (households) and, therefore, all the "functions of the aggregate" are ultimately the functions of the aggregated economic units and not of the aggregate itself.[1]

Emelianoff's analysis leads him to the conclusion that all cooperative associations, both unincorporated and those incorporated either on a stock or on a non-stock basis, including agricultural marketing, agricultural purchasing, or consumer cooperatives, and cooperatives of independent retailers and other economic units, fall into his classification of an aggregate of economic units. The aggregate consists of a technical unit (establishment) but not an economic unit (enterprise).[2] Structurally, cartels also fit into this category.[3]

2. Conclusions based on the aggregate concept

With his concept of the cooperative association as a basis, Emelianoff is able to demonstrate several important conclusions:

> Accepting the perfect aggregate structure of economic organization for the cooperative standard, we should obviously consider every deviation that distorts the aggregate structure of the cooperative body as a step toward the degeneration of this body. The basic characteristics of the aggregated plurality of economic units are:

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[1] Emelianoff. op. cit., p. 105.

[2] Ibid., p. 109-229.

[3] Ibid., p. 219.

> 1. A cooperative aggregate of economic units does not acquire nor spend by itself because it is composed of acquiring or spending units.
> 2. All the members are obliged and only the members are entitled to use the economic services of the aggregate.
> 3. All economic relationships of members within their aggregate are based on the irrevokable principle of proportionality of their economic participation in activities of the aggregate.[1]

These three points have far-reaching implications, some of which Emelianoff himself has pointed out. He has drawn a continuum with a "pure aggregate of economic units" at one pole and a "pure collective economic unit" at the other with six distinct phases of "pseudo-cooperatives" falling along the continuum. He concludes in this regard that

> . . .business transacted with outsiders is the basic factor of the degeneration of cooperative aggregates through pseudo-cooperative forms into collective enterprises.[2]

He has shown that the Rochdale Principles[3] do not correctly, clearly and completely reflect the cooperative character of the organization. Two of them, "price to members at the market" and "business on a cash basis" are business procedures and have little or nothing of peculiar concern to cooperatives. "Limited number of shares of stock per member" is not general and does not apply to non-stock associations, and certainly taken alone would not safeguard the nature of

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[1] Ibid., p. 223.

[2] Ibid., p. 230.

[3] The rules of organization and operation attributed to the

the cooperative. "Limited dividends on stock" Emelianoff has shown to be consistent with cooperative character because

> "dividends on stock" are not an income of the association, but merely interest reckonings among the members themselves. These reckonings rectify with perfect accuracy disproportionality between advances contributed and the use of services of the aggregate made by individual members.[1]

Regarding patronage dividends, Emelianoff concluded:

> To be exact we should treat them as "accounts payable" to or (in case of deficits) "accounts receivable" from members on their current transactions through cooperative associations. In pure aggregates, the surpluses (or deficits) of associations have nothing in common with the entreprenurial income of acquisitive economic units. As long as a cooperative association is treated as an "enterprise" and its surpluses are misunderstood as "profits" the economic enigma of patronage dividends cannot be solved.[2]

Of the one-man one-vote principle, Emelianoff reached the following conclusions:

> Equality, as the principle of voting, is inconsistent with the principle of proportionality underlying all other relations of members of an aggregate.[3]
>
> . . .the interpretation of a cooperative as a "union of persons" is not only without explanatory or descriptive value, but it is utterly misleading; it diverts attention from the point of cardinal significance, namely, that every cooperative organization is composed of economic units.[4]

Equitable Pioneers in Rochdale England in 1844. They are often considered the "Bible" for cooperative purchasing associations.

[1] Emelianoff. op. cit., p. 183.

[2] Ibid., p. 185.

[3] Ibid., p. 187.

[4] Ibid., p. 91.

> Voting power of members in aggregates to be consistent with their general structure should be proportional to the economic participation of individual members in the cooperative aggregate; such proportional voting is actually equal voting in aggregates with homogeneous membership, while it is necessarily unequal in associations composed of heterogeneous membership. Since a majority of cooperatives have a fairly homogeneous membership, "equal voting" is a predominant feature of cooperative. It should not be overlooked, however, that "equal voting" in cooperatives is thus a highly deceptive special case of proportional voting.[1]

Another important conclusion that Emelianoff came to is:

> The legal vestments of incorporated cooperative associations do not correspond to their economic character. The legal unit of incorporated associations conceals their plurality and cloaks their economic structure to such a degree that the law-givers as well as the economists treat cooperative aggregates as economic units. . . .Such a misapprehension is partially supported because external structural features of incorporated "capital stock" associations strikingly imitate the customary legal form of collective units. This discrepancy of the economic character of cooperative aggregates and their legal embodiment is one of the principal sources of confusion and inconsistencies in existing interpretations of cooperative organizations.[2]

Elsewhere in his book Emelianoff pointed out that the concept of the cooperative as an "agency" transacting business on behalf of its members is not only without economic basis, but is often misleading, since the cooperative is actually an integral part--a "department"--of each of the associated economic units and not "an economic body by itself. . . acting independently".[3]

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[1] Emelianoff. op. cit., p. 200-201.
[2] Ibid., p. 249.
[3] Ibid., p. 174-175.

Emelianoff reached the further conclusion that

> . . .in all cooperatives rural and urban, informal and incorporated, elementary and most complicated the association itself is the center where the economic activities of members are coordinated.[1]

He has emphasized however that

> . . .all the economic units participating in such collective endeavor own and operate their individual establishments. . ., and delegate to their collective establishment only some, and usually few, purely technical functions. . . .These technical functions delegated to the common establishment are paid for by the participating economic units at their actual cost. . .proportionally to their individual use of the common establishment. . . .[2]

Emelianoff has devoted a chapter to an analysis of the labor co-partnership, or what he has called "productive cooperative associations".

> . . .<u>every member of a cooperative association has his own economic unit to which his economic activities are mainly confined</u>. . . .
>
> The economic position of members in productive associations is entirely different in this respect. . . .The workingmen members of "productive" associations are thought of as persons <u>without their own individual enterprises or establishments they independently operate</u>.[3]

In spite of this, however, because such organizations are not organized by and for the benefit of stockholders as such but by and for the benefit of the workers, Emelianoff concluded

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[1] Ibid., p. 178.
[2] Ibid., p. 170.
[3] Ibid., p. 237.

that the labor co-partnership is not a special form of "collective enterprise" but like the cooperative is an "aggregate of economic units".[1]

In regard to the nature of the members' capital in the cooperative, Emelianoff concluded that ". . .<u>the shares of capital stock of cooperative associations are not documents of entrepreneurship but certificates of credit</u>".[2]

> . . ."capital stock" is not entrepreneurial capital of a collective enterprise, but the sum of advances needed for financing anticipated transactions of individual members of the aggregate.
> . . ."member-stock holders" are not identical with the stockholders of the collective enterprises, i.e., they are not the fractions of collective entrepreneur but the representatives of their individual and independent economic units coordinated into an aggregate.
> . . ."dividends on stock" do not represent an entrepreneurial profit or any income of the association; they are the intra-aggregate interest reckonings among the members designed to restore a perfect proportionality of the advances ("shares of capital") paid by each member and his volume of business done through the association.[3]

The final conclusion reached by Emelianoff which is worthy of note here is:

> Centripetal forces are intrinsic in every fused economic formation since they are inherent in every enterprise or household; in aggregates of enterprises or households (cooperative

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[1] Emelianoff. op. cit., p. 241-243.

[2] Ibid., p. 78.

[3] Ibid., p. 251-252.

> associations), the opposite, centrifugal forces are always at work. Economic units, be they enterprises or households, are designed for individual and independent life. In conditions of competitive economy they strive toward maintenance of their individuality and independence. If they huddle together into aggregates, they do it only under extreme objective necessity.[1]
>
> The economic stability of aggregates of economic units is inherently low. Every aggregate of economic units is saturated with disruptive forces and is kept together only by the pressure of external necessity. This is particularly true of aggregates of enterprise.[2]

3. Evaluation of the Emelianoff contributions

There is little doubt that Emelianoff has developed a sound economic concept of the cooperative association which is internally consistent, extremely useful for analytical purposes, and of considerable practical importance. Perhaps the terminology used in the book has been the greatest contributing factor to the lack of impact the work has made on the thinking and writing of marketing economists, cooperative attorneys, cooperative accountants, rural sociologists, practical cooperative leaders and others.[3] Emelianoff himself recognized some of the difficulties with the term "aggregate".

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[1] Ibid., p. 106.

[2] Ibid., p. 107-108.

[3] No doubt the fact that the book was lithographed on contract and published by the author was also a contributing factor.

> The term federation is almost identical in its meaning with the term "aggregate" used in this study and has an important advantage being a generally accepted and widely used term in economic literature. The term "aggregate" is adopted here because the term "federation" customarily relates to secondary organizations.[1]

He does not consider using "association" however, although this term would convey more clearly his meaning and not have the "loose bond" or the "grouped together with no ties in or relationship" connotation that his "aggregate" has. It is likely also that "firm" and "plant" have a more clear cut economic meaning than the terms "enterprise" and "establishment" used in Economic Theory of Cooperation, and certainly more so than "economic unit" and "technical unit" also used by Emelianoff.

It seems obvious that Emelianoff has not dealt adequately with the economic nature of the labor co-partnership. It seems odd after he pointed out the important structural distinction between the two, that he still classes the labor co-partnership along with the cooperative as an "aggregate of economic units". An individual laboring man certainly is not an economic "firm" or "household" but a factor of production the same as capital. The labor co-partnership obviously is structurally a collective firm seeking to maximize its profits the same as the stock company, except that it is organized and controlled by, and operated for the anticipated benefit

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[1] Emelianoff. op. cit., p. 104 (footnote).

of (i.e., the entrepreneurship held by) the workers in the firm rather than the capital contributors as such.

Emelianoff has not adequately dealt with the economic relationships which exist among the participating firms and serve to tie them together in the cooperative association. Perhaps in order to make his distinction between the cooperative and the collective enterprise, he has deliberately exaggerated the purely aggregated nature of the participating firms in the cooperative association. Actually the cooperative association ties the participating firms together with respect to their associated activity in a formal manner. The "flock of flying birds" analogy is not too satisfactory because it implies no formal relationship between the associated economic units. The cooperative association may be quite stable, provided it is efficiently organized and operated. Many associations exist over time successfully even as old firms discontinue participation and new ones join the association so that the entire participating membership revolves over a period of years.

With these exceptions, however, it is impossible to find major errors in the author's logic and analysis in the area covered. The area of analysis is confined almost exclusively to the economic structure of cooperatives, although the title of the book implies that a broader field has been covered.

C. The Contributions of Robotka

Unfortunately the contributions of Professor Robotka to the theoretical economic framework of cooperation are not all revealed in his published writings. Not only has his pioneer thinking benefited others who have come in contact with him in the many workshops, conferences and conventions he has attended, and as graduate students under him, but many have benefited also from his unpublished writings in this field. Such contributions are not readily accessible, and for that reason it is difficult to make specific reference to them. The comments made here are therefore based on two articles, Lego-Economic Implications[1] and A Theory of Cooperation,[2] which do not adequately reflect his thinking at this writing.

Robotka's conclusion as to the economic nature of the cooperative is essentially the same as Emelianoff's:

> . . .a cooperative. . .is. . .a federation of autonomous economic units whose avowed purpose it is to function in their individual capacities but in a coordinate manner with respect to specific activities integrally related and common to their individual economic pursuits.[3]

> The ideas basic to a concept of a true cooperative are as follows:
>
> 1. A cooperative arrangement is a horizontal combination of autonomous economic units.

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[1] Robotka. Lego-Economic. . . .

[2] Robotka, Frank. A Theory of Cooperation. Journal of Farm Economics. 29:1:94-114. 1947.

[3] Ibid., p. 113.

> 2. Because the member units retain their autonomy, it follows that the combination must have a federal rather than an authoritarian form of organization.
>
> 3. Every true cooperative represents an effort on the part of two or more autonomous units jointly to conduct, coordinately with each other, given operations essential to the economic activity of member units. It is the avowed purpose of true cooperators not to impose a business enterprise in the usual sense between themselves and their market. In a technical economic sense, this can only mean that it is their purpose to function in their own capacities as sovereign units, that is, to perform designated functions or services as integrated with their individual economic pursuits.
>
> 4. The cooperative organization consists of the sum of the relationships and arrangements established among member units in order to effectuate their purpose.[1]

Drawing on these four basic ideas, Robotka has pointed out important considerations relative to the operations of a cooperative:

> 1. The member units of a cooperative act in their own capacity as autonomous units.
>
> 2. An integrated operation does not constitute an independent profit-making unit, that is a firm. Such an operation is a branch or department of the integrating unit, or as is the case in a cooperative, of a group of integrating units.[2]

Professor Robotka has taken the position, however, that "Although the cooperative does not meet all of the specifications of a firm, it cannot be denied that it is an economic entity."[3] It is not clear from his published work whether

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[1] Robotka. Lego-Economic. . . . p. 526.

[2] Ibid., p. 527.

[3] Robotka. A Theory. . . . p. 103.

Robotka means by economic entity simply what Emelianoff calls an establishment or whether the two are fundamentally in disagreement at this point. The following quotation shows Robotka's reasoning on this point:

> Each participant must surrender sovereignty . . ., hence each participant's status as an individual maker of decisions in this particular respect is modified. Others now participate with him in this process. Those who thus participate in making these decisions, therefore, constitute a new decision making unit.
>
> It must, however, be recognized that this decision making unit cannot make decisions which are unrelated or inimical to the interests of participants as. . .producers [representatives of their sovereign economic units]. . . . Since the decisions of the participants regarding their. . .[joint] activity are now group decisions, and since those who make decisions must assume responsibility for their consequences, a new decision making body cannot emerge without a simultaneous emergence of a corresponding risk-bearing body. . . . Participants as a group will be affected by. . .particular risk situation[s] differently than they would be as non-participants.
>
> Again it must be recognized that the new risk-bearing body consists of the participants as producers. . .;[1]

Robotka has emphasized, however, that, "Although it [the cooperative] is both a legal and an economic entity, it does not pursue an economic career independent of that of its members."[2]

In other respects Robotka follows Emelianoff very closely, as the following specific examples illustrate:

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[1] Ibid., p. 103-104.

[2] Robotka. Lego-Economic. . . . p. 528.

> Its [the cooperative's] members buy and sell coordinately through the instrumentality of the cooperative. Hence the gross sales value of products accrue as liabilities to members. Likewise the expenses of the cooperative are expenses of the members, which they authorize the organization to incur in their behalf. Thus the organization as such has neither gross income nor expenses, hence it follows it cannot have a net income. . . . No true cooperative deals with its members in terms of true prices.[1]

> . . .a cooperative may or may not have capital. . . . Continuous operations requiring inventories and facilities will, of course, necessitate advances of more or less permanent capital of members. A new unit of funded capital emerges. What is the nature of this capital?
>
> Its contribution is a requirement which the member must meet in order to receive service. It is not an investment of "venture" capital in the usual sense. . . .
>
> The only justification for paying a return on members' capital is to compensate for disproportionality in its contribution by members. Members who contribute less than their proportionate share in effect borrow from those who contribute more than their proportionate share. The return to capital in such cases would be interest and not a distribution of profit.[2]

> From a strictly economic point of view, voting rights would be apportioned according to risk assumed, and since in a cooperative these are borne proportionally to patronage, voting would be based on patronage, if not strictly proportional thereto.[3]

> Many cooperative laws. . .only partially recognize the economic nature of a true cooperative

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[1] Ibid., p. 527. See also Emelianoff. op. cit., p. 185.

[2] Robotka. Lego-Economic. . . . p. 528-529. See also Emelianoff. op. cit., p. 78, 251-252.

[3] Robotka. A Theory. . . . p. 112-113. See also Emelianoff. op. cit., p. 187, 200-201.

> association. Many of them are designed to give legal recognition to intermediate stages in the evolution toward true cooperation, such as modifications of ordinary corporations designed to permit them to share profits on a patronage basis, etc.[1]
>
> The law says that a cooperative acts as agent for its members. An agent typically charges a fee for his services. Whether or not this fee covers or fails to cover his expenses is the agent's responsibility. . . . He pursues an economic career independent of that of those he serves and assumes the corollary risks. Not so in the case of a cooperative.[2]
>
> The real reason why cooperative activities are said to be conducted at cost is because they are a part of the integrated activities of the participants. . . .
>
> No true cooperative deals with its patrons on a competitive price basis. . . .a cooperative patron's interest in the transaction continues in the sense that the transaction is not consummated until it is adjusted to a cost basis;. . .the settlement at the time of the transaction is not a price settlement but a tentative or "provisional" settlement subject to adjustment after final accounting. The patronage refund under such circumstances is a device designed to adjust the transaction to a cost basis.[3]

1. Evaluation of the contributions of Professor Robotka

It is apparent that the analysis and conclusions of Robotka concerning the economic nature of the cooperative

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[1]Robotka. A Theory. . . . p. 114. See also Emelianoff. op. cit., p. 249.

[2]Robotka. Lego-Economic. . . . p. 528. See also Emelianoff. op. cit., p. 174-175.

[3]Robotka. A Theory. . . . p. 106-108. See also Emelianoff. op. cit., p. 132-133.

association follow those of Emelianoff very closely. There is a good deal of difference in the terminology used by the two authors, but upon close examination the differences appear to be not in the concepts themselves, but only in the terms used to represent them.

It is easy for the reader to misinterpret what Professor Robotka means by his discussion of the cooperative association as an economic entity. This is particularly true since the contemporary definitions of entrepreneurship and of the firm, such as those of Hart,[1] which seem to be the most useful, base the definition of a true firm on a sovereign entrepreneurial unit whose functions are residual decision-making and residual uncertainty-bearing. Robotka has made it clear, however that decisions regarding the jointly conducted activity are not made in the cooperative association as if it were a sovereign unit, but that such decisions will be made in the interest of the member firms, because sovereignty rests with them. He has shown that the risks arising from the associated activity are inseparable from those of the individual activities of the member firms. He has emphasized that

> The cooperative organization consists of the sum of the relationships and arrangements

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[1] Hart, Albert Gaylord. Anticipations, Uncertainty and Dynamic Planning. Univ. of Chicago Press. Chicago. 1940. p. 2-3.

> established among member units in order to effectuate their purpose.[1]

One must conclude that while Emelianoff has explicitly stated that the cooperative association is an aggregate of sovereign economic units and Robotka has explicitly stated that the cooperative association is an economic entity, there is actually no basic disagreement between them. Emelianoff did not intend the "loose bond" "no interrelationship" connotation that the term "aggregate" carries, and Robotka did not intend the "sovereignty apart from the participating firms" connotation that the term "economic entity" carries. Both authors, as a matter of fact, have made mention of the multi-lateral economic relationships which bind the member firms together into a functioning unit with respect to their joint activity.[2] To that extent the cooperative association is an economic entity, and to that extent it is an aggregate. The terms themselves indicate direct conflict, but actually the basic concepts of the economic structure of the cooperative association developed by the two authors are very similar and in no direct conflict.

Robotka has added materially to the contributions of Emelianoff by developing the meaning and significance of

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[1] Robotka. Lego-Economic. . . . p. 526.

[2] Emelianoff did not develop these relationships to any extent, however.

concerted integration by participating firms through their cooperative association. His emphasis on and development of the multi-lateral agreements and the economic relationships existing among the participating firms in order to bind them into a functioning unit also represents a real contribution. The two authors have provided a solid foundation upon which to build a reasonably comprehensive theory of the economic nature of the cooperative association.

III. FUNDAMENTAL THEORY OF THE COOPERATIVE STRUCTURE

The economist has given many everyday terms special meaning in his professional language. The firm is one of these terms. To the economist the firm is a sovereign economic unit,[1] within which productive resources are allocated and utilized for the production of economic goods and services. In a capitalistic society the firm is the decision making production unit, where, subject to certain government restrictions and controls, the economic decisions affecting the allocation and utilization of productive resources take place. The firm may range in size from a corner vending machine operation to a huge corporate monopoly. Be it large or small, however, every firm has its entrepreneur--the residual owner who controls the firm's decisions, bears the uncertainties of the firm and its operation, and receives the residual profit or loss resulting from these operations. Professor Hart has provided the following useful and concise definition of the firm, "A firm is defined as an organization for business purposes of productive resources under one financial control, exercised by a capitalist entrepreneur (entrepreneur for short).[2]

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[1] Sovereign in the sense that the unit pursues an independent economic career in its own best interests as an economic unit.

[2] Hart. op. cit., p. 2.

The household, to the economist, is the similar sovereign unit on the consumption side. The household may consist of a huge orphanage, of a family, or of an individual bachelor, but in any case it is a sovereign unit making the consumption decisions and bearing their consequences.[1]

An economic plant on the other hand is not a sovereign economic unit but a functioning unit operating as a part of some firm or household. A given factory, for example, might not be a firm at all, but only one of several plants under the control of one large firm. The distinguishing feature of a subsidiary plant, on one hand, and a firm or household on the other, is that the former has no autonomous entrepreneurial unit, but is operated as a part of some firm or household, which has such a unit.

What, more specifically, is this entrepreneurship which distinguishes the plant from the firm or household? Professor Knight has written,

> It is this true uncertainty which by preventing the theoretically perfect out working of the tendencies of competition gives the characteristic form of the enterprise [firm] to economic organization as a whole and accounts for the peculiar income of the entrepreneur.[2]

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[1] To the extent that the household has productive resources at its command it will also consider the optimum employment of these resources, either by making them available for hire to firms or by utilization in an individual proprietorship firm identified with the household.

[2] Knight, Frank H. Risk, Uncertainty and Profit. Houghton Mifflin Co. New York. 1921. p. 198.

Thus entrepreneurship grows out of the uncertain business world and in the firm consists of the residual uncertainty bearing and the ultimate decision making responsibility.

> The capitalist entrepreneur is a person or group of persons making the firm's fundamental decisions--as a minimum choosing the managing personnel--and putting up enough capital to make the firm financially responsible. . . .Active management including much of the firm's basic planning, may be carried on by employees who are not members of the entrepreneurial group but act in its interests.[1]

The actual entrepreneurial decision in such cases is the decision as to what managerial personnel to employ and the decision to delegate the decision-making to such persons. As Emelianoff has so aptly pointed out, ". . .entrepreneurial responsibility cannot be delegated to anybody under any conditions or in any degree. The idea of 'salaried entrepreneur' is preposterous."[2]

It is this concept of entrepreneurship which clarifies the economist's term profit. Profit, or "pure" profit as it is sometimes called, is associated with, and only with entrepreneurship.[3] A plant cannot make a profit or suffer a loss. Its operations can only add to or subtract from the profit of the parent firm.

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[1]Hart. op. cit., p. 2. See also Knight. op. cit., p. 308.

[2]Emelianoff. op. cit., p. 65.

[3]Knight. op. cit., p. 311.

Legal incorporation does not change the economic nature of a firm or of a plant. A firm may be incorporated or unincorporated. A plant may also be (and often is) incorporated as a legal entity, but its economic nature remains unchanged.

A. Cooperative a Multi-Firm Plant

When a group of individual firms[1] form a cooperative association they simply agree mutually to set up a plant and jointly operate it as an integral part of each of their individual firms (or households in the case of the consumer cooperative).[2] They must agree to function coordinately with respect to their joint activity. This agreement runs multi-laterally among the participating firms, however, rather than between each of them and the joint activity as such. These participating firms must function as an economic team in relation to their coordinated activity, and submit some of their individual sovereignty to themselves as a team. The joint activity as such, however, has no economic life or purpose apart from the individual activities of the participating firms. It represents a part of the total production

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[1] The term "firm" used here and elsewhere will be understood to mean firm or household, since structurally cooperatives of firms and cooperatives of households are identical.

[2] See Robotka, Lego-Economic. . . . p. 522-533.

activities of each of these firms, which they have coordinated by multi-lateral agreement. It is technically correct to speak of the cooperative plant and of cooperating firms, but not of the cooperative firm or of cooperative enterprise.

The cooperative association is not an organization of persons, either as laborers, as capital contributors, or as patrons, for that matter. It is an organization, as Emelianoff points out, of sovereign economic units--firms or households.[1] Saying that a cooperative association is a business organization owned and controlled by its patrons and operated for their benefit as patrons, while descriptively correct, contributes nothing to the understanding of the economic structure of the cooperative. Although capital and even labor may be involved in it, patronage, unlike capital or labor, is not a productive resource capable of earning an economic return in the production of goods and services. It is not possible "to organize an economic system from the standpoint and for the benefit of the. . .patron"[2] as the controller of a given factor of production, but it is possible for firms to jointly organize and operate a common plant with the idea of maximizing the economic returns to each of the individual associated firms.

The entrepreneurs of the associated firms must each

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[1] Emelianoff. op. cit., p. 249.

[2] Nourse. Legal Status. . . . p. 21.

allocate productive resources to their common plant, however, the same as a multi-plant firm must allocate resources to each of its plants. From the standpoint of resource allocation the associated firms in a cooperative cannot be in static partial equilibrium (under the profit maximization assumption) unless resources are allocated to the joint plant to the point where the marginal productivity of each resource in the cooperative plant is equal to the marginal productivity of that resource in the individual plants of each of the member firms, and the marginal productivity of the last dollar is equal in every use within each firm.

The cooperative is a plant operated jointly as a part of several firms--nothing more, nothing less. The cooperative as such has no entrepreneurial unit; its member units each have their entrepreneur. Although each retains its individual sovereignty, all member firms are more than aggregated[1] with respect to their joint plant--they are associated by multilateral agreement in a rather definite manner. They are not merged however. Except for their joint operation of the cooperative plant they are unassociated and uncoordinated, functioning entirely independently of one another. Each entrepreneur arrives at production equilibrium considering his

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[1] See Emelianoff. op. cit.

separate activities plus his proportionate share of the joint activity together as an integrated production unit.

This structure is visualized in Figure 1. The triangular numbered sections represent the member firms and the small uninscribed circle at A their joint plant. Notice that the complete firm in each case includes a part of the joint plant at the center (i.e. BAC for firm 4), and that there is no connection between the firms except where they come together in the jointly operated plant. Note also that this joint plant is indistinct except as a part of each of its member firms. If all firms were to withdraw (move outward from the center) there would be no cooperative plant left. If one firm were to withdraw (number 3 for example) a section of the plant would be removed, and its size correspondingly reduced.

Figure 1 illustrates another important consideration in this multi-firm plant. It shows how the individual cooperating firms share in their joint plant where the size of these firms is not uniform. The larger the firm the larger is the percentage of the total cooperative plant represented by that firm. It can be readily seen, for example, that the output of the joint plant would be reduced much less by the withdrawal of firm 2 than by the withdrawal of firm 17.

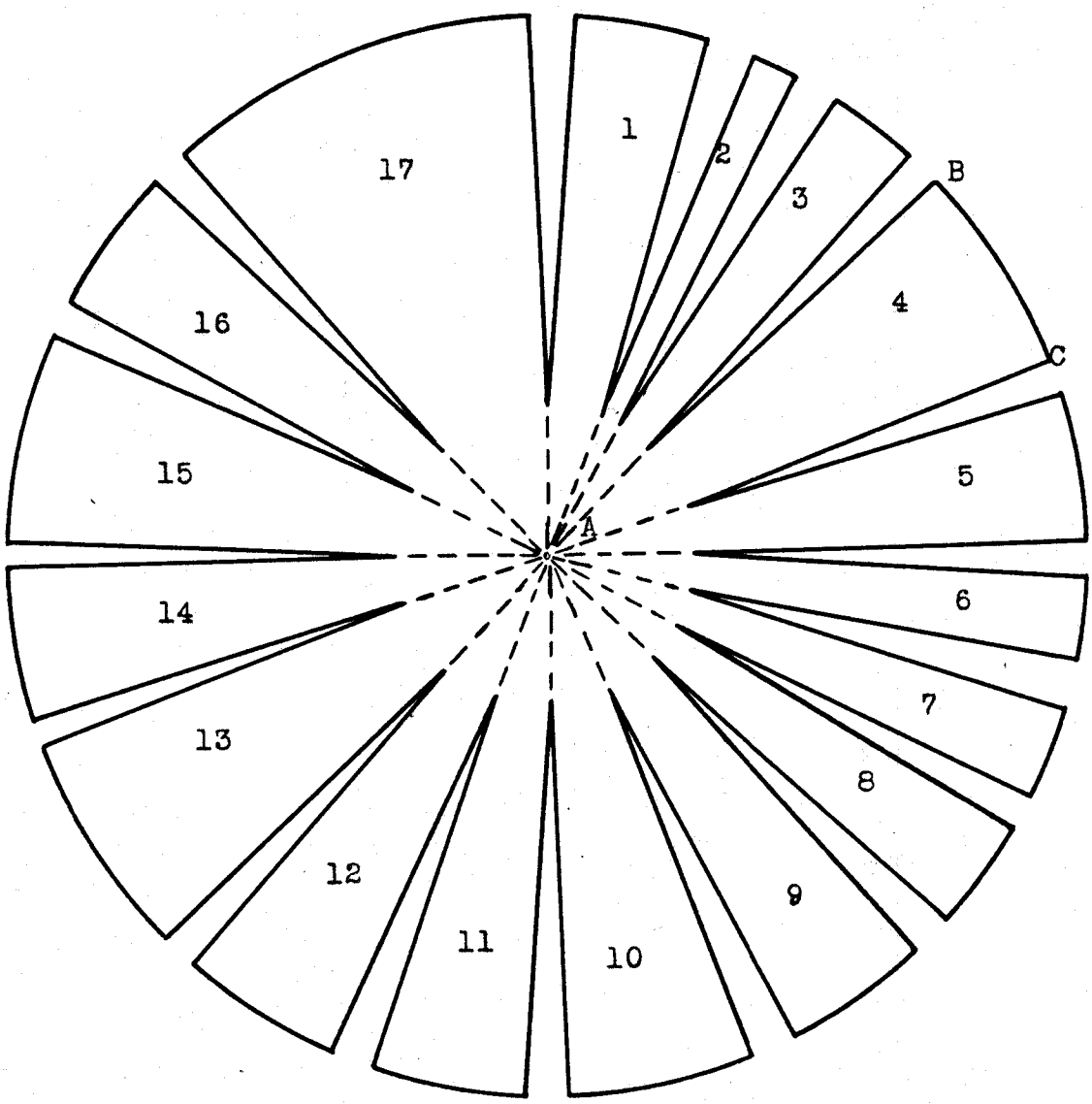

Figure 1. The cooperative structure.

B. The Relationship Among Cooperating Firms

Emelianoff has adequately written,

> All economic relationships of members within their aggregate are based on the irrevocable principle of proportionality of their economic participation in activities of the aggregate [cooperative].[1]

What are these economic relationships between member firms arising from their joint operation of a common plant? They have to do with (1) the use made of the plant, (2) the decision making regarding the plant and its operations, (3) the financial responsibility for the plant, (4) the fixed and variable costs of operating their plant, (5) the uncertaintities in connection with the plant and its operations, and (6) the economic benefits (positive or negative) which result from operating this joint plant.

Concerning each of these relationships the cooperating entrepreneurs are faced with the questions of who will participate in these relationships and how they will be shared by the participants. On the basis of the framework presented here, the responsible group is obviously the sum of the entrepreneurs of the individual firms that are operating the plant jointly. No other group can be expected to

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[1] Emelianoff. op. cit., p. 223.

use the plant, to exercise control over it, to assume the financial responsibility for it, to bear the costs in connection with it, to bear the consequences arising from uncertainties in connection with it, or to partake of the economic benefits of the joint plant.

The only equitable way these enterpreneurs of the individual cooperating firms can share in these economic relationships is on a proportional basis.[1] Proportionality is determined by the percentage use which the size of each firm dictates its entrepreneur will make of the joint plant.[2] Not only is this the only way which will be mutually satisfactory to all participating entrepreneurs, but a static equilibrium position within the cooperative and the member firms cannot be reached if they are shared in any other way.[3] The method of sharing all the other economic relationships among the cooperating firms is therefore specified according to the proportionate use (patronage) of the joint plant made by each.

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[1] This proposition, and others which follow in this chapter, are demonstrated in Chapters IV through X.

[2] Where the joint plant performs a limited function (e.g., churning and marketing butter) the size of the parent firms which determines the percentage of use each entrepreneur will make of the plant will only be that part in each firm related directly to the functions of the plant (e.g. pounds of butterfat produced).

[3] Because the conditions for optimum resource allocation within each participating firm will not be met if they are shared on any other basis.

In a one department cooperative for a given operating period, the proportionate use made of the cooperative by the entrepreneur of each participating firm will, in other words, determine the method of sharing the control (voting), the uncertainty bearing, the costs, the financial responsibility, and the economic benefits incident to or arising from the joint plant. Therefore from the standpoint of economic structure, voting in the cooperative association will not be shared on a per firm (one-man one-vote) basis but on a use (patronage) basis; all costs including costs of risks will be shared on a use basis; the uncertainty bearing will not be shared on a per firm basis but on a use basis; financial responsibility (i.e., either providing the actual capital or paying the interest rate and providing the security required to obtain it) will be shared on a use basis; and the economic benefits, if any, will be shared on a use basis.

What is the nature of these economic benefits from the joint plant accruing to participating firms on a patronage basis? As a matter of fact this is not really a distinct economic relationship at all, from the standpoint of theoretical structure, but one which is covered in the cost sharing relationship. Presumably the participating entrepreneurs would agree to set up and operate the joint plant only in anticipation of making the operations of their individual firms more profitable. They organize the plant in order to use it in the operations of their individual firms. When the

costs of the plant and its operations are shared on a basis proportional to the use made of the plant, the contributions of the joint plant to the profits of the participating firms are automatically distributed proportionately among them. This is true because with both gross returns and costs shared on a basis proportional to use, the net returns, if any, are obviously shared on the same basis. In practice the proportional sharing of costs may be worked out by a pooling operation where settlement is made after the pool is closed and costs have been determined and deducted; by a tentative settlement and a patronage refund (usually positive, but conceivably negative) at the end of the operating year when costs have been determined; or by direct assessment of costs proportionate with use to the member firms as the actual costs are incurred or anticipated.

Given perfect knowledge and certainty, the rule of proportionality in the sharing of the economic relationships among the cooperative firms also applies over time and between departments. Under these assumptions the firms jointly operating each department will participate in all economic relationships in proportion to their use of that department. Furthermore all relationships arising from the operation of the joint plant that are common to several departments will be pooled by the firms participating in each of the departments concerned and shared among them on a basis proportional to the fraction of total operation of the joint plant

represented by each of their departments. Firms operating a department making up 60 percent of the whole joint plant operation, for example, will as a group carry 60 percent of the voting control in matters concerning the plant as a whole, bear 60 percent of the joint costs, 60 percent of the joint uncertainties, and carry 60 percent of the joint financial responsibilities.[1] Costs, uncertainties, financial responsibilities, and decisions specific to a given department will be of concern only to the firms jointly operating that department.

What about the interfirm relationships over time which arise from participation in the joint activity? A given proportional sharing of the joint plant (such as that shown in Figure 1) for one operating period will not necessarily hold for other periods. Proportionality must therefore be maintained between the groups of participating firms in each operating period as well as within each such group. All relationships which extend over time will be shared among the groups of firms operating the joint plant in each period on a basis proportional to the relative size of the plant in each period.[2] Relationships which are specific to a given

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[1] Assuming that 60 percent of the total of each of these joint relationships relates to the operation of this department.

[2] Providing the relationships affect each operating period on a basis proportional to the size of the plant operation in each period.

operating period will be participated in only by the group of firms sharing in the joint activity in this period. Intertemporal and interdepartmental relationships are pooled among the participating firms involved and shared proportionately by them both within and between the participating groups. Relationships specific in time and by department will be shared only by the participating group of firms concerned.

Under conditions of uncertainty and imperfect knowledge, proportionality is also the basis upon which firms participating in a joint plant share the multi-lateral economic relationships, including those which are interdepartmental and intertemporal. It is planned proportionality rather than actual realized proportionality, however, which determines the method of sharing the economic relationships among the participating firms under these conditions. It may also be economic to pool uncertainties specific to a given department or time period in order to reduce the expected dispersion around the most probable anticipated values of relevant variables facing each participating entrepreneur. How far they will go in this direction depends upon the anticipated uncertainties, the expected reduction of such uncertainties by interdepartmental and intertemporal pooling, and the indifference toward relative certainty and relative efficiency of the majority of

the participating entrepreneurs.[1] To the extent that specific uncertainties are pooled, they also must be shared among the groups of participating firms involved on the basis of anticipated proportionality in order to fulfill all efficiency criteria.

C. Profit Maximization and the Cooperative

Following the orthodox static assumptions, the cooperating firms individually seek to maximize their profits, considering that part of their operations in the jointly operated plant as well as their individual operations outside of it. Two conditions are necessary in order to accomplish this purpose. In the first place each participating firm must be in production equilibrium. Secondly the joint plant must be of optimum size. Although these two are related, it is possible for either one to be met without meeting the other. The profits of the participating firms are not maximized unless both are met.

The necessary production equilibrium conditions are the same as those for any firm. The best combination of outputs will be produced at the least cost combination when the ratio

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[1] See Lange, Oscar. A Note on Innovations. Review of Economic Statistics. 25:1:19-25. 1943. p. 20.

of the marginal expenditure for the input[1] to the marginal physical productivity of the input[2] times the marginal return for the output produced[3] is equal between all inputs in the production of all outputs within the firm. The optimum firm size will be defined at the output which equates the marginal revenue with the marginal cost of each product produced and for all products taken together. These conditions together mean that the marginal revenue productivity[4] must equal the marginal expenditure for each input in the production of each output.

The participating firms are ordinarily vertically integrated in the sense that the output of the joint plant is the raw product input of the individual plants of the participating firms, or alternatively the output of the individual plants of the participating firms is the raw product input of the joint plant.[5] As products move from one plant to another in

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[1]Defined as the increment of the firm's total cost for inputs resulting from an additional unit of this input.

[2]Defined as the net addition to the physical outputs of the firm resulting from the use of an additional unit of this input.

[3]Defined as the increment of the firm's total revenue for output resulting from the sale of the added amount of this output plus the sale of the net change in amount of other outputs.

[4]Defined as the product of marginal physical productivity and marginal return.

[5]The exception is the plant operated jointly by two or

a vertically integrated firm no transfer of title takes place and no price is established for them. Such a firm is not interested in the profitability of any one of its plants considered alone, but rather in the profitability of the complete chain of integrated plants operating as a unit. The optimum output is determined on the basis of the complete operation and if measured in comparable units will be the same for each of the plants. The vertically integrated firm determines this optimum output by equating the sum of the marginal cost functions in all plants with the marginal revenue in the final plant from which the product is marketed.[1] The cooperating firm equates the sum of the marginal cost in its individual plant or plants and the marginal cost in the joint plant with the marginal revenue facing the firm in the market where the product is sold. This criteria

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more firms to procure specific capital resources, such as farm machinery for agricultural firms. In this case each participating entrepreneur will equate the marginal cost in the joint plant with the marginal revenue productivity of the resource in his individual plant.

[1a] See Hirsch, Werner Zvi. The Economics of Integration in Agricultural Marketing. Unpublished Ph. D. Thesis. Univ. of California Library. Berkeley. 1950. p. 97-144. Hirsch does not deal with this general case although it follows logically from his analysis. He deals instead with the following conditions respectively: (1) no charges (costs) in any plant except that farthest from the consumer, (2) only fixed charges (costs) in all plants except that farthest from the consumer, (3) per unit charges (costs) at a constant rate in all plants except that farthest from the consumer, (4) where fixed payments are made outside the firm for services, and (5) where a fixed per unit payment is made outside the integrated firm for services.

applies both to short run and to long run analyses.

The relevant segment of the marginal cost function in the joint plant to each participating entreprneeur is that part beginning with the sum of the equilibrium outputs of all other participating entrepreneurs rather than at zero output. Each entrepreneur must consider the additional costs in the joint plant resulting from his volume of output. The precise equilibrium output of any one participating firm cannot be determined unless the equilibrium output for all others is given, because without this information the exact segment of the marginal cost function which is relevant is unknown.[1] Formal solution of the optimum output for each participating firm and in the joint plant, given the number of participating firms, is possible by simultaneous equations only. If the output product of the participated firms is marketed from their joint plant, everything which has been said about the relevant range of the joint plant marginal cost curve to each firm is true also of the relevant range of the marginal revenue curve.

Aside from variations due to the adjustment of optimum output in each firm, the size of the joint plant is determined by the number and size of the participating firms. The economic motivation for cooperation among sovereign firms is

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[1] This is not true if the marginal cost function is horizontal over the relevant range.

a decreasing long run average cost curve over a considerable range for a part of the total economic function, or contemplated function, of the several firms. By pooling this part of their activities and functioning coordinately through a common plant, they are able, under these conditions, to increase their economic efficiency by more closely approaching optimum size for this operation. Once several firms agree to set up and operate a plant jointly, they are interested in obtaining the size in their joint plant which will maximize plant efficiency and make the greatest possible contribution to the profits of each participating firm. When the optimum size for the joint plant has been determined, this optimum is maintained over the long run by varying the number of participating firms. Plant size is reduced by failure to replace firms that retire from participation and expanded by encouraging new firms to participate.

How is the optimum size for the joint plant determined? The joint plant will be of optimum size when the long run average net return from the plant is at a maximum because the greatest contribution of the plant to the profit of each participating firm, regardless of the size of the firm, will be at this point.[1] Where the output of the joint plant is raw

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[1]Cf. Phillips, Richard. Sharing Risks and Uncertainties in Farmer Cooperatives. Unpublished M. S. Thesis. Iowa State College Library. Ames. 1949. p. 72-84.

product or specific resource input for the individual plants of the participating firms, optimum size in the joint plant is defined by the minimum point in the long run average cost function in the joint plant. This cost function includes fixed and variable resource costs and costs of the raw product inputs; it is comparable to the long run average cost function in an individual firm performing the same function as that performed in the joint plant. Since the participating firms face no revenue function from their joint plant, optimum plant size will not be the same as the optimum size for such an individual firm, however, unless the demand curve for output facing this firm is perfectly elastic.

Where the output of the individual plants of the participating firms is the raw product input of the joint plant, the optimum size for the joint plant is defined at the output which maximizes the vertical distance between the long run average revenue curve and the long run average cost curve in the joint plant. The plant long run average cost function in this case is net of the cost of raw product inputs supplied from the individual plants of the participating firms. Again the long run optimum size for the joint plant will not necessarily be at the same output as the optimum size for an independent firm in the same environment unless the demand curve for output and also the supply curve for the raw product input for the firm are perfectly elastic and the other conditions of perfect competition are met.

If the production carried on by the participating firms makes it economic, and if the long run per unit joint cost decreases with volume in the joint plant, the participating firms will all maximize their profits by adding departments, each of optimum size, in the joint plant until a size is reached which minimizes the long run per unit joint cost. The determination of the long run optimum size in the joint plant is distinct from the determination of the long and short run optimum size for each participating firm. Long run optimum joint plant size is achieved by varying the number of participating firms, each of long run optimum size. Both optimums must be reached if the profits of each participating firm are to be an absolute maximum.

IV. THE MULTI-FIRM PLANT CONCEPT

The key to an understanding of the economic nature of the cooperative structure is the multi-firm plant concept, and the interfirm relationships resulting from the joint ownership and operation of a common plant. It is only on the basis of such a concept that the applied economist can adequately deal with the many questions and problems which practical cooperators and such professional people as cooperative accountants and cooperative attorneys bring to him today. Insurmountable difficulties and inconsistencies arise when the cooperative is looked upon as a firm and its operations studied apart from the individual operations of members. Hirsch,[1] for example, has made substantial progress in analyzing vertical integration when undertaken by a large firm operating plants at different levels, but has dealt entirely inadequately with integration in agricultural marketing through cooperation (the field to which he addressed himself) because of his implicit assumption that the cooperative association as such is a firm.

As a teaching device, and even for analytical purposes, the cooperative association is often compared to the stock company, and the similiarities and differences between the

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[1] Hirsch. op. cit.

two noted. This is actually comparing an association of economic units with a single sovereign economic unit and is misleading both to the student of cooperation and the economic analyst. The appropriate comparison is between the cooperative association and other formal associations of economic units such as the cartel and the trade association, as the conclusions of both Robotka[1] and Emelianoff[2] suggest.

A. Cooperative Association not a Firm

What actually happens when a group of firms (or households) find it economic to form and operate a single plant jointly? They obviously do not merge and lose their identity as individual firms. If, instead of forming a joint plant, the twenty-seven firms in Figure 1 had merged, the demarcations between the individual firms would no longer be evident and the new firm resulting from the merger would be described by an unbroken circumference embracing the entire structure.

Neither do they jointly set up a new firm between themselves and the market with which to do business. If such were the case, point A in Figure 1 would be enclosed by an unbroken circumference and the seventeen individual firms would not touch each other at all, but would be held together only by

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[1] Robotka. A Theory. . . . and Robotka. Lego-Economic . . . .

[2] Emelianoff. op. cit.

a "pipeline" from each of them to the new firm. The individual entrepreneurs of the seventeen firms would as a group comprise the joint entrepreneur (a new uncertainty bearing and decision making body) for the central firm. There would be no multi-lateral relationship among the seventeen firms--only a relationship between each of them and the central firm. As with all firms, this central firm would pursue its own economic career as guided by the dictates of its joint entrepreneur, piping its profits (positive or negative) back to the seventeen parent firms, allocating them among the seventeen according to the basis in which they share in the joint entrepreneurship.

It is about such a concept of the cooperative as this which has long been implicitly assumed by many economists, and which implicitly guides the thinking and action of many cooperative members and leaders today. Many, if not most of our state cooperative laws tend to throw the cooperative into this sort of framework. Such a firm-theory of the cooperative association is faulty and misleading, however, both from the point of view of economic logic and from the point of view of practical application, as Emelianoff has quite forcefully pointed out.[1] The concept ignores the relationship between the individually conducted business activity of the member

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[1] Emelianoff. op. cit.

entrepreneurs and their activities conducted jointly through the cooperative arrangement; it fails to adequately recognize the multi-lateral relationships between the associated member firms; it cannot explain the economic nature of patronage refunds; it cannot accurately define the equilibrium position in the cooperative association and in the individual member firms; and it cannot explain or aid in the solution of the many problems peculiar in their nature or in their application to the cooperative association. It is, in short, an entirely unsatisfactory concept.

Returning to the original question of what happens when a cooperative association is formed, it is apparent that a new firm does not emerge. The joint plant set up by the member firms remains a plant in an economic sense. The plant, as all plants are, is only a part of a parent firm--in this case a part of the several member firms. The joint plant is as closely integrated with the rest of the economic activities of the member firms as is a plant set up and operated as a part of a single firm (see Figure 1).

B. Multi-Lateral Agreement between Firms

In order to set up and operate a plant jointly, however, two or more firms must multi-laterally come to an agreement with respect to their plant--they must agree to operate it jointly and coordinately. This multi-lateral agreement is a

formal one--ordinarily a binding contract between sovereign and otherwise independent firms. This formal agreement does not alter the entrepreneurial decision making body--that function continues to rest with the individual firms. It does, however, involve coordination of the activities and functions of the decision making units with respect to the joint plant.

In order to achieve this coordination, the individual entrepreneurs of the cooperating firms must sacrifice some individual decision making sovereignty with respect to the joint plant since each must consider the views of all the other entrepreneurs participating. As a group they must reconcile conflicting views and arrive at a single coordinated decision concerning each of the economic issues faced by the joint plant.[1] It is to this extent true that the decision making function of the cooperating entrepreneurs is modified with respect to their joint plant. They remain individual cooperating entrepreneurs, however, and do not become a joint entrepreneur. Each makes his decisions relative to his firm as a whole--that part in the joint plant as well as that part outside of it. His decisions outside the joint plant are entirely independent, but with respect

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[1] The study of this process is largely in the field of the sociologist rather than that of the economist.

to the joint plant they must be coordinated with those of the other cooperating entrepreneurs. Such coordination is achieved by an entrepreneurial decision by each participating firm to enter into appropriate legal and economic relationships with the other firms of the group.

The situation with respect to the uncertainty bearing in connection with the joint plant is analogous. As with all plants there is no distinct uncertainty bearing body apart from the parent firms. The uncertainty is borne by the entrepreneurs of the firms jointly operating the common plant. The uncertainties facing the individual firms may be and usually are modified when they set up and operate a common plant between them. Some of the uncertainties, as the individual firms face them, may be reduced and others may be increased. They also pool the uncertainty bearing as far as the joint plant is concerned, thus cutting down the range of the probability distribution of uncertainties facing each of them. They may even pool the uncertainties facing the cooperating firms arising from the operation of their joint plant over time and between different departments in the plant.

Thus when two or more firms set up a joint plant, as far as this joint plant is concerned they must agree to make the entrepreneurial decisions as a group and bear many of the uncertainties of entrepreneurship as a group. As Professor Robotka[1] has suggested, this agreement between the cooperating

[1]Robotka. A Theory. . . . p. 102.

firms is an important and distinctive feature of the cooperative structure. No group of firms could jointly operate a common plant without it. It is this agreement which makes the cooperative association what it is because it specifies the multi-lateral economic and legal relationships established among the participating firms. No such agreement is needed in the case of a single multi-plant firm, be it the result of outright merger, simple expansion or the absorption of one firm by another. This agreement between cooperating firms is, in fact, the cooperative association.

This agreement by firms to coordinate a part of their economic activities by formalizing the process of making decisions and bearing uncertainties as a group by no means creates a new entrepreneurial unit. The firms as a group operate the joint plant as a part of each firm. There is no group apart from the individual firms. The agreement by which they accomplish their purpose simply specifies that as individual firms they will share the decision making and uncertainty bearing of the joint plant, and the manner in which they will share these functions. There is no economic relationship between any one of such firms and any new economic entity. The economic relationships are interfirm relationships. They run multi-laterally among the firms making up the group, and pertain only to the operations of the joint plant.

It is entirely unrealistic to focus attention on the

operations of the cooperative plant apart from the firms of which it is a part. It pursues no economic career of its own, but is operated by the entrepreneurs of the participating firms to further the interests of their respective firms as they individually pursue their economic careers. The entrepreneurial decisions made relative to the operation of the joint plant consider not only the plant as such but its relation to the entire operation of the member firms, as an integral economic part of each of them. The only fruitful approach, therefore, is to consider the economic behavior of the member firms, including that part of each in the joint plant, and the multi-lateral economic relationships between these member firms arising from their coordinated activities in the joint plant.

C. Interfirm Relationships

Although it may be outside the role of the theoretical economist in the more narrow sense,[1] it is appropriate to take a closer look at this multi-lateral relationship between firms resulting from their decision to set up and operate a common plant jointly. With respect to that part of their individual economic activities as firms which is involved in the joint plant, they have decided to function coordinately.[2]

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[1] I.e., as distinguished from the "political" economist.

[2] This fact is sometimes expressed by the statement

Each participating entrepreneur must agree to function as a member of the group of participating entrepreneurs. He must agree to assume his proportionate share, and only his share, of economic participation (contributing resources, making decisions, bearing uncertainties, bearing costs, and also receiving economic benefits) with respect to the joint plant. He owes this responsibility to the other participating entrepreneurs as individuals, not to the group as such. It is only under these conditions that the several entrepreneurs as individuals will agree to take part in the joint plant.

With respect to the coordinated economic activity, each participating entrepreneur must sacrifice some of his "rugged individualism", and agree to become one member of an economic team. He must submit to team decision, as determined by the majority of the individual members of the team, even though they may sometimes conflict with his individual interests. He must agree to share uncertainties and costs, regardless of his own position. If the interests of the individual participating firms differ very much, the joint operation of a plant will be uneconomic to them, because the economies of scale in the plant will be more than offset by the disadvantages resulting from the individual differences among the firms. This problem does not arise

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"they have decided to cooperate rather than compete". E.g., see Robotka. A Theory. . . . p. 101.

among participating units of a joint entrepreneurship, such as in the stock company or labor co-partnership, since they are concerned only with the economic objectives of a single firm, rather than the objectives of the several firms operating a common plant in a cooperative association.

The cooperating firms, however, sacrifice no sovereignty whatsoever with respect to their individual operations outside the joint plant. The individual entrepreneurs carry complete responsibility and function entirely apart from the others as far as this part of their operations is concerned. The cooperating entrepreneurs as a team have no influence over the activities of the individual participating firms which are outside the joint plant. For this part of their operations the usual economic models of competition, monopolistic competition, oligopoly, etc., depending upon organization of the industry, are appropriate for the cooperating firms, except that the economic behavior of each firm considers that part of the firm in the joint plant as well as the part outside of it.

The fact that firm decisions outside the joint plant are uncoordinated has a bearing on the joint operation because while most of the decisions affecting the plant are made by the participating entrepreneurs coordinately as a group, some are made by them individually and entirely independently of

one another. The most important of these uncoordinated decisions are the determination of the short run output of the joint plant, and the size of the plant insofar as it is affected by entry and withdrawal of firms from participation in the joint plant. The short run output is determined by the sum of the products handled through the plant by each member entrepreneur, and each entrepreneur makes this decision, as far as his own firm is concerned, independently of the others. In a potato marketing cooperative, for example, the majority of the entrepreneurs in the participating group does not decide the volume of potatoes to be produced in each farm firm, and does not therefore decide the short run volume of potatoes marketed through the cooperative association. This decision is made in each firm individually by its own entrepreneur, so that the short run volume in the joint plant is specified a priori as far as the participating entrepreneurs as a group is concerned.

The size of the joint plant is also to a large extent specified by the participating entrepreneurs individually. While the cooperating group can limit new firms from participation in the joint plant, the group cannot prevent withdrawal of individual participating firms. Furthermore even though the nature of the long run average cost function in the joint plant warrants it, the participating entrepreneurs as a group cannot force new firms to participate in the joint plant. The decision to participate in or to

withdraw from the joint activity is a decision made individually in each firm. The entrepreneurs as a group may be able to influence both the short run output and the size of the joint plant by education, promotion or even chastisement of the "uncooperative" firms, but not by coercion.

The individual participating entrepreneurs perform the entrepreneurial function on a "pool" basis with respect to their joint plant, but on an individual basis with respect to the operation of their individual firms outside the joint plant. As has just been seen, however, some of the individual entrepreneurial decisions affect the joint plant. When the sovereign units pool their entrepreneurial function concerning the joint plant, they do not lose their individual identity and become a joint entrepreneur, but they must abide by majority decision if they are to function successfully on a coordinated basis in this respect. This pooled entrepreneurship may result in better entrepreneurial decisions by a "hybridization" of the best of the individual entrepreneurial thinking, and in a net social gain by reducing the range of the probability distributions of uncertainties facing the individual entrepreneurs of the pool. The entrepreneurial efficiency may be cut down, however, by the slowness and red tape of democratic action.

D. Federated Cooperatives

Cooperative activity has been called "concerted integration"[1] because in the usual case when firms jointly set up and operate a plant they integrate vertically by adding functions related to their individual operations but not duplicating them. They integrate vertically forward toward the consumer (marketing cooperatives) or backward toward the primary producer (purchasing cooperatives). Firms that are too small to achieve the economies of vertical integration individually and that insist on retaining their individual identities may find it economic to associate and operate the integrated plant jointly, so that concerted integration aptly describes the arrangement. This could be shown in Figure 1 in three dimensions by elevating the undescribed circle about point A vertically upward from the page. Varying degrees of integration could be shown by varying heights of this elevation.

This integration is often carried much farther by cooperative federations--secondary cooperative associations whose members are primary cooperative associations. The resulting structure can be mentally visualized in three dimensions by imagining two or more multi-firm plants (like

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[1] See Robertson, D. H. The Control of Industry. Harcourt, Brace and Co. New York. 1923. p. 49.

Figure 1) with the joint plant of each extending at right angles to the parent firms, and these several joint plants connected at the ends most removed from their parent firms to form a new central joint plant at the center. The central joint plant becomes a part of the several integrating joint plants, each of which is, in turn, a part of each of its parent member firms. Neither any integrating joint plant nor the central joint plant can be called a firm in such federations of cooperative associations. The central joint plant, as a part of each of the integrating joint plants, is ultimately a part of the firms jointly operating the several integrating plants. Through coordinated action the participating firms have carried vertical integration one step farther.

The central plant does not have an autonomous unit of entrepreneurship any more than the integrating plants do. The whole integrated structure is controlled by and operated for the participating firms as such. Although necessarily coordinated with that of all the others, the individual entrepreneurship of each participating firm has simply been extended. The member firms must furnish or hire the productive resources used in the central joint plant as well as in the integrating joint plants and any economic gains or losses resulting from the whole operation accrue to the individual firms. The central joint plant does not pursue an independent economic career any more than the integrating plants do. The

parent firms pursue their economic careers through their several respective joint integrating plants and their common joint central plant. Goods and resources do not change hands as they move from firm to joint integrating plant, or from integrating plant to joint central plant. No real price is established as they move within the structure, but only as they move into the structure from outside firms, or from it to outside firms.

The economic relationships in a cooperative federation run multi-laterally among the several internally coordinated groups of firms. In the operations of the integrating joint plants outside the central joint plant, the internally coordinated groups of firms operate entirely independently of one another. With respect to the central joint plant operations, however, these groups function coordinately in an intergroup sense. As internally coordinated groups they multi-laterally agree to share the decision making and uncertainty bearing of the joint central plant on a proportional basis--to function as an economic team of teams. All the previously discussed relationships between the participating firms, and their functions independently and as a group, apply to the participating groups of firms in the cooperative federation. Furthermore federation does not change the intragroup relationships between participating firms at the primary level. The cooperative federation is a plant jointly operated by two or more multi-firm plants.

V. THE PROPORTIONALITY CONCEPT

The proportionality concept is basic to an understanding of the multi-lateral economic relationships which arise among a group of cooperating firms when they jointly operate a common plant, and of how the cooperating firms share these relationships.[1] This proportionality is determined by the basis on which they share in the economic activities of the group--the basis on which the participating firms share the joint plant.[2] The joint activity is an integrated part of the total production activities of each participating firm. The extent of those activities in the individual plants of each participating firm which are integrated with the joint activity determines the proportionate participation of each firm in the joint activity. If the joint activity is a marketing plant, this proportionality is determined by the percentage of the total input of products to be marketed in the joint plant which is produced in the individual plants of each of the participating firms. If the joint activity is a purchasing plant, proportionality is determined by the percentage of the total output of the joint plant which serves as input in the individual plants of each of the participating

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[1] See Emelianoff. op. cit., p. 223.

[2] The assumption throughout this chapter is a single department joint plant over a single operating and accounting period, e.g., a year. The modifications when these assumptions are dropped are considered in the two succeeding chapters.

firms. The proportion of the total joint plant included as a part of each of its parent firms will be defined by the relative size of the production activities in the individual plant (or plants) of each parent firm that are integrated with the operations of the joint plant (see Figure 1). Thus in a wholesale meat purchasing cooperative, the proportion of the joint plant included as a part of each of the participating grocery firms will be determined by the relative size of the retail meat departments, which utilize the output of the joint plant, in the retail stores of each of the participating firms.

This method of sharing in the joint activity by the respective associated firms is usually referred to as being on a patronage or use basis, i.e., based on the use each firm makes of the joint plant. Proportionality to use or patronage has been pointed out as determining the basis on which all of the economic relationships arising from the operation of the plant are to be shared by the participating firms.[1] This statement is factually correct because the use each makes of the joint plant (purchases or sales through it) is a measure of the size of the production activities in the individual plants of the member firms which are integrated with the activities of the joint plant. Consequently proportionate use or patronage is a measure of the fraction of the joint plant which is a part of each of the cooperating firms.

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[1]See Emelianoff. op. cit., and Robotka. A Theory. . . .

Proportionate use of the joint plant follows logically from the structure of the cooperative association; it is a measure of this proportionality among the cooperating firms.

Proportionality is the only basis for sharing the economic relationships in connection with the joint activity which will be mutually satisfactory to each of several participating entrepreneurs. Each entrepreneur must provide inputs in the joint plant in the same proportion that he shares in the total output of the joint activity. Each must assume entrepreneurial responsibilities for the joint activity in the same proportion that he shares in the total anticipated economic benefits from the production activities conducted in the joint plant. If these conditions are not met, a misallocation of resources among the firms participating in the joint activity will result. In order to achieve interfirm equilibrium within the cooperative structure, all inputs in the joint plant must be shared by the participating firms on the same basis as they share the output of the common plant, and all entrepreneurial responsibilities must be shared by them on the same basis as the anticipated economic gain from the joint activity. This means that the participating firms must share the economic use of the joint plant on the same basis as they share the plant (see Figure 1); that they must share the entrepreneurial decisions, the uncertainty bearing, the financial responsibility, the costs,

and the economic benefits in connection with the joint activity on the same proportional basis.

A. Use of the Joint Plant

The use made of the joint plant by each of the participating entrepreneurs, then, may be considered one of the economic relationships arising when a multi-firm plant is formed. They will share the use of the plant on the same basis as they share the plant as a part of each of their firms, as illustrated in Figure 1.[1] As long as he remains a member of the associated group and has resources allocated to the joint plant, each entrepreneur will, if he acts rationally in the best interests of his firm, make his full proportionate use of the joint plant.[2] Since the joint plant is part of the total integrated production activity of each firm, the resources of the firm in the joint plant are productive only if used by the firm. If participation in the joint plant is uneconomic, the firm should withdraw completely from the association. As long as a firm continues to have resources allocated to the joint plant, it is economic nonsense to

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[1] This almost goes without saying, of course, since it was anticipated additions to the profits of the participating firms through use of (economic production in) the joint plant which motivated its organization in the first place.

[2] Or, in the terminology of practical cooperative circles, give his cooperative 100 percent of his patronage.

discontinue use of the plant as long as variable costs can be covered in the joint activity. In short run situations where variable costs cannot be met by operating the joint plant, it may be in the best interests of all participating entrepreneurs to let the joint plant remain idle during the period when such conditions exist.

If the per unit costs in the joint plant decrease with volume over the relevant range, each firm also owes it to the other participating firms to make full proportionate use of the joint activity. Failure to do so would mean increased costs in the joint activity to the other participating firms. The participating entrepreneurs have multi-laterally agreed that each will continue to make proportionate use of their joint plant as long as it is economic to do so. This agreement is necessary so that the cooperating firms as a group will be able to achieve economies of size in the plant, and so that each firm will be able to make its integrated operations successful.

*On the other hand, on the basis of theoretical structure, each entrepreneur must multi-laterally agree with the other participating entrepreneurs not to use the joint plant in an amount in excess of the proportion of the total joint plant included as a part of his own firm. To do so would give him a greater share of the economic benefits of the joint plant, if any, than the proportion of the entrepreneurial functions

of uncertainty bearing and decision making in connection with the joint plant assumed by him. It would give him a share of the output from the joint plant which is disproportionately higher than the share of the total input in the joint plant provided by him. This is true because explicit costs in the joint plant to each participating firm do not cover all inputs. Some resources used in the joint plant are allocated directly to the joint activity by the participating firms, so that the cost of their use is implicit rather than explicit to each firm. If any one participating firm uses the joint plant to an extent greater than proportional to the amount of such resource inputs provided by that firm, a misallocation of resources among the participating firms results. The gain to this firm in such case will be at the expense of all or part of the other participating entrepreneurs. Therefore, the individual entrepreneurs will agree to set up and operate a common plant jointly only on condition that each participating entrepreneur will assume an increased fraction of the joint plant when his use of the joint activity increases, so that proportionality among the participating firms will be maintained.

B. Entrepreneurial Decisions

It has been seen (Chapter IV) that the individual entrepreneurs of the cooperating firms make the entrepreneurial

decisions concerning the operation of the joint plant as representatives of autonomous economic units, rather than by becoming part of a joint entrepreneurial unit, but that they function coordinately as members of the participating group. Entrepreneurial decisions specific to the joint plant must be the joint decisions of the participating entrepreneurs, rather than the sum of the uncoordinated decisions made by each of the several participating entrepreneurs separately. Each entrepreneur must abide by "team" decisions with respect to the joint activity; he has multilaterally agreed with the other participating firms to do so.

Only in a structure where sovereign economic units function coordinately with respect to a part of their total production activities is the entrepreneurial decision making function pooled in this sense. As a group they must reconcile conflicting views and arrive at a single coordinated decision concerning each of the economic issues faced by the joint plant. The decision on each of these issues affects each participating entrepreneur on a proportional basis, not only with respect to his share of the associated activity, but, because of the integrated nature of the two, with respect to his production activity outside the joint plant as well. If an entrepreneur anticipates that many of the pooled decisions will conflict with the best economic interest of his firm, participation in the joint plant is

likely to be uneconomic for him.

The cooperating firms will share in this pool of entrepreneurial decision making on a proportional basis--on the same basis that they share the joint plant and its use. The way each participating entrepreneur registers his own decisions concerning the joint plant is by his vote on specific matters requiring decision as they come up. It follows from the economic structure of the cooperative association that they will vote proportionally.

This conclusion of proportional voting conflicts with the wide acceptance of the one-man one-vote (actually one-firm one-vote) method of sharing control in cooperatives. As Emelianoff[1] and Robotka[2] have pointed out, however, equal voting is only a special case of proportional voting, where the participating firms share the joint plant approximately on an equal basis. Cooperating firms have learned through the hard knocks of experience that equal voting causes difficulty when they share the joint plant on an unequal basis, but also because of the difficulty in many cooperatives of predicting exactly how the joint plant will be shared among the participating firms by the time the results of the ex ante entrepreneurial decision become reality. Equal

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[1] Emelianoff. op. cit., p. 187-201.

[2] Robotka. A Theory. . . . p. 111-113.

voting may be the best approximation available. Nevertheless, the arguments often given by cooperative leaders for equal voting, e.g., it is real economic democracy; the cooperative is an association of people, not capital; etc., largely represent dogma in cooperative thinking.[1] They are completely without scientific economic basis.

Where the number of firms participating in the joint plant exceeds a certain maximum (say fifteen or twenty) it becomes necessary for them to develop definite machinery for making the pooled entrepreneurial decisions. The more detailed of the entrepreneurial decisions concerning the joint plant are ordinarily delegated to a board of directors, while the broad entrepreneurial policies are established, and the board of directors is selected, by all participating entrepreneurs at annual meetings or special meetings for this purpose. The pooled entreprneurial decisions are made at such meetings by majority vote,[2] with each participating entrepreneur voting on a proportional basis. In deciding how he will cast his vote each entrepreneur considers not only the operations of the joint plant as such, but the whole operation of his individual firm.

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[1] See Nourse, Edwin G. From Dogma to Science in Cooperative Thinking. In American Cooperation; 1946. p. 6-13. American Institute of Cooperation. Washington, D. C. 1946.

[2] The participating firms may specify in their article or by laws that specific entrepreneurial decisions require more than a simple majority.

The more detailed entrepreneurial decisions are delegated to the board of directors by the participating entrepreneurs as a group. Directors are elected from the group of the individual participating entrepreneurs according to their ability to make sound entrepreneurial decisions and to represent adequately the interests of at least the majority of the individual participating entrepreneurs. Those elected will not necessarily be from the participating firms which share the largest fractions of the joint plant. The participating entrepreneurs delegate entrepreneurial decisions concerning their joint plant to the board of directors as a body only. No director or officer has authority to make entrepreneurial decisions for the whole group as an individual. If a salaried manager for the plant is hired, he is responsible to the board of directors as a board, not to the individual directors as such, in exactly the same sense that he is responsible, through the board, to the participating entrepreneurs as a group, but not to any one of them individually. The manager makes only those decisions regarding the operation of the plant which have been delegated to him. He is not an entrepreneur in any sense of the word, but a highly specialized laborer whose productivity in the plant will determine his salary, considering the market price for such productivity.

In order to insure that the board of directors will represent the entire group in the entrepreneurial decisions

delegated to them, the participating entrepreneurs in the joint plant usually provide that as a group they can remove from office and replace any directors, or all of them, by a vote of some specified majority of the participating entrepreneurs. Furthermore, unlike a joint entrepreneurship, the individual entrepreneurs operating a common plant jointly usually get into difficulties and internal dissention if they delegate too much entrepreneurial decision making responsibility to their board of directors.[1] If they are to be followed by successful execution, many of these decisions require the support of all participating entrepreneurs. This can hardly be expected unless they all take part in making these entrepreneurial decisions, and do so on a proportional basis.

C. Uncertainty Bearing

The entrepreneurs of the participating firms bear the economic uncertainties of their joint activity as a group. These firms share the uncertainty bearing responsibility as they share the joint plant. The uncertainties arising from the economic activity of the joint plant are certainly not eliminated, but are modified because of the fact that

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[1] This point is discussed in some detail in section C of Chapter XII.

several firms own and operate the plant together. Each participating entrepreneur must bear the uncertainties of the economic activities of his complete firm, which includes his proportionate share of the joint plant (see Figure 1). New uncertainties face his firm as the firm is expanded by adding the additional functions. If he is unable or unwilling to bear these new uncertainties in view of the anticipated higher profits to his firm, it is uneconomic for him to cooperate.

Uncertainties as they face any firm, including firms operating a plant jointly, as contrasted to risks, cannot be insured against or introduced simply as items of cost. The uncertainties facing the entrepreneur of any firm may be classified as follows:

1. Market uncertainties--caused by unpredictable factors of supply and demand conditions and ordinarily manifested by unpredictable prices of:
   a. The factors of production
   b. Inputs (raw materials)
   c. Output (finished product)

2. Technological uncertainties--manifested as obsolescence of present methods of production, plant and equipment, certain inputs or even output, and caused by:
   a. Mechanical innovations
   b. Chemical innovations
   c. Biological innovations
   d. Organizational innovations

3. Technical uncertainties--caused by the unpredictable nature of some factor or factors in the production function

4. Operational uncertainties--unpredictable phenomena in the operation of the firm, such as:

a. Curtailed production because of labor strikes
b. Loss of key figures in management
c. Governmental interference, as:
   (1) Taxes or other unfavorable legislation
   (2) Intervention, or restriction of output or raw materials.[1]

In addition to these four, entrepreneurs of individual firms which operate a common plant jointly face a fifth type of uncertainty which grows out of the fact that the entrepreneurial decisions concerning their joint plant must be made coordinately, resulting in a common decision for the group. The author has called this fifth type of uncertainty "membership uncertainty".[2]

> The degree of this peculiar uncertainty in the cooperative is dependent on the ability of its member [entrepreneurs] to get along with one another--to agree on the policy of the cooperative. The greater the homogeneity of interests of the members, the less important this type of uncertainty becomes. . . .[3]

Examples of membership uncertainty facing each participating firm in a cooperative association include, (1) uncertainty of continued participation of the other associated firms, (2) uncertainty as to whether or not the pooled decisions will coincide with the best interest of the individual participating entrepreneur, (3) uncertainty as to whether or not the board of directors will accurately and efficiently represent the best interests of the majority of the participating

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[1] Phillips. op. cit., p. 22-23.

[2] Ibid., p. 102.

[3] Ibid., p. 104.

entrepreneurs, and (4) uncertainty of the continued operation of the joint activity over time.

It is important to recognize that the participating entrepreneurs bear the uncertainties of the operation of their joint plant, even though many of them are pooled within the group, in their respective firms as such. Individually each entrepreneur is faced with uncertainties because of the operation of his firm as a whole. He must consider the uncertainties arising from the operation of his complete firm, the same as the entrepreneur of a single vertically integrated firm must consider the uncertainties arising from all of his plants as they face the firm as a whole. The uncertainties face each participating firm as a whole and the profits, if any, accrue to the participating firm as a whole. This structure is entirely different from that in joint entrepreneurships, such as the stock company, where the uncertainties face the company as such and are shared among the individuals making up the joint entrepreneur according to their proportionate share of this entrepreneurship.

The joint operation of a plant, as distinguished from the addition of a plant by a single firm, modifies the uncertainties arising out of the operation of the plant which face the individual participating entrepreneurs by spreading or pooling them. As a group the participating firms bear all the uncertainties arising out of the operation of the joint plant. These uncertainties are shared by them on a

proportional basis. Thus the actual uncertainty facing each participating entrepreneur includes his proportionate share of the total uncertainty arising out of the operation of the joint plant. When an unpredictable loss occurs, all participating entrepreneurs bear their proportionate share of it, rather than the few out of the whole group who would be affected directly if the uncertainties were not pooled. Since none of them know a priori where or when the unpredictable loss might occur, this pooling of uncertainties arising from the joint plant operations reduces the anticipated dispersion around the probable expectations faced by participating entrepreneur. None of the uncertainties connected with the operation of the joint plant are eliminated, but they are spread among all the participating firms. This has the effect of reducing the uncertainty facing each entrepreneur, as compared to the case where each conducts the same total production activity individually.

The participating firms bear these uncertainties which arise from the operation of the joint plant, directly as firms. Intrafirm movement of resources and products between plants does not involve title change nor establish a price for them. Therefore the market uncertainties arising from the operation of the joint plant are borne directly by the member firms on a proportional basis because they retain title to all the products and resources in the joint plant on a proportional basis. Uncertainties as to the future

productivity of the fixed plant and equipment, though ordinarily specific to the joint plant, are borne by the entrepreneurs of the participating firms as a group and are shared by them on a proportional basis. These uncertainties face the individual participating firms on a proportional basis also because the entrepreneurial ownership of the facilities of the joint plant is held by these firms as such and shared by them on a basis proportional to their relative size and therefore their proportionate utilization of the joint plant.

D. Financial Responsibility

The participating firms bear the financial responsibility for their joint activity as a group and share it as individual participating firms on the same proportional basis as they participate in the ownership and economic utilization of the joint plant. It should be made clear that the proportionality concept defines how the participating firms will share the financial responsibility for the joint plant, not necessarily how they share in providing the actual capital for the plant. As long as participating firms bear the economic uncertainties and share them on a proportionate basis, it is immaterial whether they actually own the capital resources used in the plant or simply hire them in the capital market. This applies not only to the firms concerned as a group, but for each participating entrepreneur individually, regardless of the

position of the other participants.

Owners of liquid capital resources are concerned not only with maximizing the interest rate on their money, but also about security against losing their principal, so that the quantity of capital supplied is a function of both the interest rate and the reciprocal of the risk of loss of principal.[1] Consequently, the participating firms will discharge their proportionate financial responsibility in their joint plant by putting up enough actual capital on a proportional basis to provide security sufficient to attract loan capital at the market rate of interest and agreeing to share the interest expense on a proportional basis as an addition to plant operating costs for the remaining capital needed.

Cooperating firms will each be required to put up enough direct capital so that as a group they have enough to provide security to lenders. The percentage this will be of the total capital required for the joint plant depends upon the absolute amount and percentage owner equity in the participating firms,[2] the dollar size of the joint plant

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[1] And also other variables, of course, such as the expectations regarding interest rate changes in relation to the length of the loan, expectations regarding the purchasing power of money, liquidity preference, etc., all of which are highly important in other regards but of little concern here.

[2] Because the joint plant is an integrated part of these firms, so that owned equity in the individual plants can serve as security for loan capital needed in the joint plant.

compared to that of the member firms, and the magnitude of the uncertainties facing the entire operations of the member firms, including the joint plant. Whatever percentage the owner equity may be of total capital, the capital which must be allocated directly to the joint plant by the participating firms will be shared by them on a proportionate basis. Such capital will draw neither a fixed rate of interest nor a dividend. Its use cost is simply an implicit cost to each participating entrepreneur in the operation of his complete firm.

In cases where the marginal productivity of capital varies considerably between the several individual firms participating in the joint plant, it will be economic to modify the above generalization to permit the member firms to share the direct allocation of capital on a disproportional basis while still sharing the full financial responsibility on a proportional basis.[1] This may be quite simply done within the group of participating firms by allowing those in which the marginal productivity of capital is low to contribute more than their proportionate share of the required actual capital and those in which the marginal productivity of capital is high to contribute less than their proportionate share.[2] The

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[1] Erdman is describing this case when he writes ". . . cooperative-mindedness is not coextensive with ability to contribute capital to a cooperative association." Erdman, H. E. Shifting the Financing Burden Among Members of Cooperatives. In American Cooperation - 1946. p. 562-566. American Institute of Cooperation. Washington, D. C. 1946. p. 562.

[2] Under the restrictive assumptions of a perfect capital market it would be impossible to better the economic position of either group of firms by the modification, of course.

incentive to the former firms to do so will consist of compensation in the form of the necessary fixed rate of interest. Under this arrangement participating firms will provide actual capital for the joint plant on a proportional basis up to a point somewhat short of that necessary to make the operation financially secure, and the difference will be made up by interest bearing loans made to the group as a whole by those firms in which the marginal productivity of capital makes it economic to do so. The interest on these loans will be an item of cost in the plant operations. This cost will be borne by all participating firms and shared by them on a proportional basis, like all other costs. In an empirical case, given the marginal productivity of capital of each participating firm and the total capital required for security in the joint plant to outside lenders, the solution, in terms of the equilibrium interest rate on these loans, the amount of such loans by each firm to the group as a whole, and the proportions of member firm capital allocated to the joint plant in the form of these loans and also on a proportional basis, can be formally worked out.

If the marginal productivity of capital in all participating firms is less than the market rate of interest on loan capital, it will be economic to have one hundred percent member firm equity in the joint plant; but as long as marginal productivity of capital in some of the participating firms is higher than the market rate of interest, it will not be

economic for them as a group to be "debt free" in their joint plant. It will be economic for them to secure the use of some borrowed capital. If the marginal productivity of capital is below the market rate of interest in some of the member firms, but not all of them, it will be economic for those with low marginal productivities of capital to make loansttthe group as a whole, the same as an outside lender would, at the market rate of interest.

The group of cooperating firms will seek to obtain their loan capital from whatever source they can get it most economically, and on the most favorable terms. They may get some of it by selling "bonds" or other "bond-type" securities to the general investing public, as well as to some of the participating firms, and some of it by securing both long and short term loans in relatively large denominations from commercial lending agencies and similar sources. Regardless of the source of loan capital to the group, the interest on this borrowed money is a cost item in the joint plant to be borne by all participating firms as a group, and shared among them on a proportional basis.

E. Costs in the Joint Plant

All fixed and variable costs, including those of risks, arising from the operations of the joint plant will be borne by the participating firms as a group. They will be shared by these firms in the same proportions as they share the joint

plant. The amount of cost borne by each participating firm will be equal to the product of the average total unit cost in the joint plant times the number of units of the product or service it moves through the plant.[1] The actual per unit cost and the resulting per unit net return in the joint plant will not present a complete picture to the participating firms, since the goods and resources do not change title in movement from the member firms to the joint plant or vice versa. In the first place, the more of the resources in the joint plant owned by the participating entrepreneurs on a proportional basis, the less will be the explicit per unit cost of operation in the plant.

In the second place, when the output of the individual plants of the participating firms is input to the joint plant, the net per unit return to member firms from the plant appears to be higher than is actually the case since plant costs are net of the raw product input cost. Per unit costs in the participating firms outside the joint plant, in addition to those in the plant, must be considered in order to arrive at a realistic net revenue. When the output of the joint plant is input to the individual plants of the participating firms, the firms first take title to products or

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[1] Except where discernable anticipated differences in the costs to different firms exist, in which case cost differences will be taken into account in determining the cost and net return to each participating firm.

specific capital resources in their common plant as a group. They do not receive revenue for them until the products are sold from their individual plants, or until the resources have been utilized in the production of saleable goods and services in these plants. In this case also, the per unit costs in both the joint plant and the individual plants of each firm must be taken into account.

The fixed costs of the joint plant are usually known ex ante and could accurately be provided for in advance on a proportional basis by the participating entrepreneurs. Total unit costs cannot ordinarily be determined until the end of the accounting period, however. Consequently the participating firms generally operate their joint plant either on a "pool" or a "purchase and sale" basis, or a combination of the two. When the joint plant is operated on a "pool" basis, the participating firms individually have title to all products in the joint plant on a proportional basis. When the products are moved out of the joint plant and the transaction completed, the pool is closed and participating entrepreneurs receive the net returns, after all plant costs have been paid, on a proportional basis. Each participating entrepreneur incurs the average per unit cost in the plant and receives the average net revenue for his proportionate share of the volume.[1]

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[1] See footnote on previous page.

When the participating firms operate their joint plant on a "purchase and sale" basis, a tentative settlement is made with each entrepreneur at the time the product moves out of his individual plant into the joint plant, or vice versa. This tentative settlement is made at a level sufficient to cover estimated per unit costs in the joint plant plus a margin for safety, and is adjusted to actual cost at the end of the accounting period by the patronage refund. Patronage refunds are made at a uniform rate per unit of patronage (use) to all participating firms for any operating period, which results in their allocation among the firms on a proportional basis.[1] They will be large or small (and even conceivably negative) depending upon the relationship of actual realized per unit cost in the joint plant to the tentative settlement made with each entrepreneur. Both the "pool" and the "purchase and sale" methods of operation in the joint plant provide for the sharing of net per unit cost incurred in the joint plant among the participating firms on a proportional basis.

F. Economic Benefits

The method of sharing the economic benefits, if any, of the joint plant among participating firms is a corollary of

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[1] See footnote on page 95.

the method of sharing the use made of and per unit costs in the joint plant. Since these firms share the use made of the plant and the per unit costs in the plant on the same proportionate basis, they share the benefits of the joint plant proportionately also.

The patronage refund does not measure the economic benefit of the joint plant to the participating firms. In the first place it is not universally used in cooperative associations--there may be no patronage refund at all in a "pool" operation. It is simply a device by means of which tentative charges to the participating firms are adjusted to actual per unit costs in joint plant in the "purchase and sale" type of operation. It has just been seen that the size of the patronage refund depends upon the relationship between tentative settlement and realized per unit cost in the joint plant. Furthermore explicit per unit costs will be high or low in the joint plant depending on the percentage of total capital and other resources in the joint plant furnished directly by the participating firms on a proportional basis and on which no use rate as an operating expense is paid. So even if one hundred percent of the amount remaining in the joint plant after all operating expenses are paid is allocated proportionately to the participating firms as a patronage refund, the size of these refunds does not accurately reflect the economic benefit of the joint plant to each participating firm.

The benefit to each participating firm can only be estimated by comparing the total per unit cost (implicit as well as explicit) of the services rendered in their own plant over an operating period with the costs and services to them which they expect would prevail in the absence of their joint activity.[1] These benefits of the joint plant will be shared among the participating firms on the same proportional basis that they share the joint plant and its economic use. This is really only another way of saying that the cooperating firms share the total per unit cost of their joint plant on a proportional basis.

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[1] It is likely that they cannot find exact duplication by outside firms of the services performed in the joint plant, either because outside firms provide services they are not willing to pay for (e.g., advertising) or fail to provide wanted services, or because of economies of integration which would not be available outside the joint plant.

VI. PROPORTIONALITY OVER TIME

In a given accounting period a group of firms operating a common plant jointly will participate on a proportional basis in the multi-lateral economic relationships resulting from the fact that they have associated themselves and mutually agreed to operate the plant jointly. It is evident, however, that intertemporal relationships must be considered also since such joint plants are ordinarily operated continuously over many accounting periods. Furthermore the proportionate participation in the joint plant by the cooperating firms, and even the cooperating firms themselves may change over time. Therefore what Samuelson calls "comparative statics"[1] must be considered in any analysis of the economic relationships arising from the structure of the multi-firm plant. Not only must the relationships among the firms operating the joint plant for each accounting period be considered, as has been done, but the relationships between the groups of firms operating the joint plant in different accounting periods must also be taken into account.

When the operations of the joint plant over time are considered, the structure visualized in Figure 1 is not a constant picture ordinarily, but over several operating

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[1] Samuelson, Paul A. Foundations of Economic Analysis. Harvard University Press. Cambridge. 1948. Chap. 9.

periods some of the firms may include a larger fraction of the total joint plant and others a smaller fraction, so that the proportionality among them changes. If a long enough time period is considered, and the functions of the joint plant are still economic to the participating firms, a substantial proportion of the firms originally taking part may have been replaced by new firms. The total number of firms participating may have increased or decreased. In both agricultural and consumer cooperatives this turnover of participating firms and changes in the proportionality among them will be more rapid than in cooperatives of corporations such as railroads or factories, but this tendency for shifting participation at least proportionately is a general one in cooperative associations. Provision must be made to adjust to shifts in proportionality within the group of participating firms from one operating period to another. The group operating the joint plant in each operating period will be somewhat different, even though the same firms may be involved, because they will share the plant on a somewhat different proportional basis in each operating period. The instances of no change in membership or proportionality are only a special case of the general one which permits these changes.

The intertemporal relationships between the different groups of coordinate firms operating a plant jointly does not

change the multi-lateral relationships between the participating firms in each time period. The proportionality rule pointed out in the previous chapter continues to specify how the participating firms will share the entrepreneurial fnctions of decision making and uncertainty bearing, economic use, financial responsibility, total unit cost, and economic benefits in connection with their joint plant in each operating period. And within each group the results of pooling these functions by coordinate firms continues to hold without modification when the intertemporal relationships are considered.

It is, then, the relationships among groups of firms participating in different accounting periods which are of concern at this point. To be considered are the effects of averaging these relationships between the different operating periods over time and the proportionality guide for sharing them among the groups of participating firms in different accounting periods. This is done in two steps; first the intertemporal relationships are considered under the assumption of perfect knowledge and certainty, and second the necessary modifications in the analysis under imperfect knowledge and uncertainty are considered.

A. Perfect Knowledge and Certainty

With perfect knowledge and no uncertainty, the economic

relationships which extend over time will be shared by the participating firms of different time periods as groups, with each group participating in each relationship on a proportional basis. Those relationships which do not extend over time but which are specific to a given operating period in the joint plant will be participated in only by the group of firms participating in that operating period.

Under these assumptions the economic relationships between the groups of firms operating the joint plant in different time periods do not include the sharing of uncertainty bearing and the sharing of entrepreneurial decision making, since these two functions result only from imperfect knowledge and uncertainty. Relative participation in entrepreneurial decision making is not essentially different from that in the routine decision making retained under this assumption and little modificiation will be necessary when it is dropped. The sharing of the uncertainty bearing function over time will be developed in the succeeding section. The relationships that remain are the sharing of the economic use of the joint plant, the sharing of routine decisions in connection with the operation of the common plant, the sharing of the financial responsibility for the joint plant, the sharing of the fixed and variable costs of the plant, and the sharing of the economic benefits from the joint plant between the groups of firms operating it in different time periods.

No intertemporal group will incur more than its proportionate share of these relationships in the joint plant, either by sharing in any of the relationships specific to another operating period, or by sharing more than its proportionate part of the relationships which are pooled over several operating periods.

Consider first the relationships in connection with the joint plant which are specific to a given operating period. Under the above assumptions, it would represent a misallocation of resources to pool these relationships specific to one period over several periods of time. To do so would require that the group of firms operating the joint plant in any period subsidize the group operating it in some other period, or conversely to be subsidized by another group. The firms operating the joint plant in any given operating period will share its use proportionately as they share the joint plant in that period, not proportionately as they shared it in some past period, or as they will share it in some future period. They will share the decisions concerning the joint plant specifically in a given period on the same basis, and will make such decisions independently of the firms operating the joint plant in past or future operating periods. They will share the financial responsibilities specific to a given operating period on a basis proportional to the basis on which they share the joint plant in this same period, and without subsidy from or tax to the firms operating the joint

plant in any other period. They will also share the average variable costs, and therefore the economic benefits, of the plant for this operating period on this same basis and subject to the same restrictions. All the economic relationships among the participating firms specific to a given operating period in the joint plant will be participated in only by those firms and shared among them on the same basis as they share the joint plant in the same operating period.

The relationships arising from the operation of the joint plant which are not specific to a given operating period, but which are joint or pooled over several operating periods must be borne by the groups of firms operating the joint plant in each operating period. Under the assumed conditions of certainty and perfect knowledge, they will be shared by these groups on a proportional basis; each group of firms will collectively participate in these relationships extending over time on a basis proportional to the relative fraction of the joint plant operations over the entire period of time considered represented by its respective operating period. As long as the size of operations of the joint plant remains relatively constant over time, the groups of participating firms operating the plant in the different accounting periods included will participate equally in intergroup relationships extending over time. Where the size of the plant, as measured by fixed investment rather than short run variations in output, is increased or decreased over time,

however, the groups of participating firms will not share these intertemporal relationships equally, but instead according to the proportionate size of the joint plant operations in each operating period. The sharing of these intertemporal relationships on an equal basis is thus only a special case of sharing them on a proportional basis. In this respect the situation is exactly parallel to the sharing of the economic relationships among the participating firms for a given operating period in the joint plant.

It should be emphasized that it is the relative size of the joint plant in the different accounting periods which determines the proportionality for sharing the relationships extending over time. Proportionality is not determined by different positions along the short run cost curve, but only by different positions along the long run cost curve, which represent different short run cost curves altogether. Short run variations in the output of the joint plant modify the costs and returns specific to a given operating period, but not those which are joint over time. If the size of the joint plant does not change over time, even though short run output varies from one operating period to another, participation in the intertemporal relationships by the groups of firms operating the joint plant in different time periods will be on an equal basis. It is only as the size of the joint plant is gradually expanded, or gradually contracted, that they will participate on an unequal, although still

proportional, basis. In both cases these relationships will be shared proportionately by the firms participating in any given period.

These relationships which extend over time arising from the operation of the joint plant include decisions concerning the plant which extend over more than one operating period, the fixed costs and the costs of risk which are pooled over time, and the financial responsibility for the fixed plant and equipment and inventories carried from one operating period into another. Intertemporal decisions will be shared among the groups of firms operating the joint plant in different time periods and shared proportionately by them. This is true both in the case where new firms replace some of the old ones as participants in the joint activity over time and in the case where the same firms share the joint plant in different operating periods, but on a different proportional basis in each period. Suppose, for example, in a plant operated jointly by three firms, a decision made in one time period affects the participating firms not only in that period, but in the three succeeding ones as well. Suppose further that the three firms do not share the joint plant on the same proportional basis in all four operating periods, but on a 3-3-4, 2-4-4, 2-5-3, 2-6-2 basis in the four respective operating periods. If the effects of the decision on the three firms will be spread equally over the four periods, they will participate in the decision on a 9-18-13 basis

rather than a 3-3-4 basis; if the effects will be twice as strong in the third and fourth period as in the first and second, they will participate in the decision on a 13-29-18 basis; if all the effects will fall in the fourth operating period they will share the decision on a 2-6-2 basis; if the first firm planned to discontinue participation in the joint plant after the second period and the effects were spread equally over the four periods, the firms would share the decision on a 5-18-13 basis; and there are many other possible bases for sharing the decision, each under different assumptions, in this simple example. With perfect knowledge and certainty decisions affecting several time periods will be made jointly by the several groups of associated firms and participated in proportionately by these groups.

Fixed costs in the joint plant are pooled through time and shared proportionally by the groups of cooperating firms in the different time periods involved. This is done simply, from an accounting standpoint, by amortizing the fixed plant and equipment over their expected life and levying a uniform annual depreciation charge against the group of firms operating the joint plant in each accounting period. If the size of the plant is expanded the annual depreciation charge will be greater in operating periods dating from the expansion; if the size of the plant is contracted by liquidation of a part of it, annual depreciation charges will be smaller from that point forward over the life of the plant. Costs of

inventories carried over from one operating period to another will be shared proportionately by the group of firms operating the joint plant in the two operating periods. This can be done by maintaining comparable opening and closing inventories for each operating period, by allowing inventories to vary but maintaining total working capital at a constant level at the beginning and close of each accounting period, or by making other adjustments between the groups of firms for the various periods when differences occur.

The average cost of risks which are pooled over several time periods are also shared on a proportional basis by the groups of firms operating the joint plant in these time periods, regardless of the particular time period or periods in which the actual loss arising from the risk occurs. Perhaps the simplest and most common wayof accomplishing this is to set up a contingency reserve for each risk arising out of the operation of the joint plant. The contingency reserve is built up by a small per unit addition to operating costs in each period and is drawn on by the group of firms operating the joint plant in the period when losses occur.

Not only do the groups of firms operating the joint plant in different operating periods share the fixed costs in the plant, but they also share the responsibility of providing the capital for the fixed plant and equipment, either directly or by providing the security and interest necessary to

attract outside capital. Interest on borrowed capital used to finance the fixed facilities in the joint plant is an item of fixed cost, the sharing of which has just been discussed, but the capital provided by the participating firms directly is a distinct relationship of special significance over time. The fixed plant and equipment requiring such capital cannot economically be liquidated at the end of each operating period, but must be maintained over their useful life of many operating periods. With a turnover of firms participating in the joint plant, and/or a change in the proportionality among them during the useful life of the fixed plant and equipment, a basis of sharing the allocation of capital to the joint plant which is proportional in the first period certainly will be neither proportional nor equitable several periods later. It is apparent that some formal or informal method of revolving the allocations of capital to the joint plant by the participating firms will be necessary over time if conformity to the proportionality criteria is to be maintained.

Regardless of the method used by the participating firms for proportionately allocating capital to the joint plant in the first period, it is clear that adjustments must be made in succeeding periods as participation and proportionality change. With a constant plant size, a constant member firm equity in the plant, and constant money value over time, these adjustments must bring about reapportionments

of the money allocations of capital within the group of cooperating firms as their proportionate participation changes, and as old firms drop out and new ones take their place as participants in the joint activity. As firms withdraw from the joint activity their capital equities in the joint plant will be returned to them, and be replaced by capital allocated to the plant by the new firms which take their place. As cooperating firms decrease their participation in the joint activity, their capital equity in the joint plant will be proportionately decreased, while the equity in the plant of firms increasing their participation will be correspondingly increased.

If the size of the plant is expanded, the participating firm equity in the plant is increased, or the value of money decreases over time, the participating firms as a group will increase their money allocation of capital to the joint plant from one operating period to another. If the size of the joint plant is contracted, the participating firm equity in the plant is decreased, or the value of money increases over time, allocations of money capital to the joint plant by the participating firms as a group will be decreased. If one of these three factors is operating in one direction and one or both of the other two in the other direction, so that they exactly offset one another, the money capital allocated to the joint plant by the firms participating as a group will

be constant over time. If working in opposite directions, however, these three factors are likely not to offset one another exactly, so that the net effect will be either a positive or negative change from one time period to another. Regardless of the presence or direction of change in the allocation of money capital to the joint plant by the group of participating firms as a whole over time, the allocation of capital to the joint plant by each participating firm must be adjusted to keep the direct capital equity in the joint plant in the hands of the particular firms participating in the current time period, and so that it will be shared among them on a basis proportional to their participation in the joint plant in the current period.

There are different methods by which this can and has been done in cooperative associations. It may be done directly by requiring each participating firm to provide its proportionate share of the money capital required in the joint plant in the initial period in cash as a condition of membership, and thenceforth adjusting directly the capital allocated to the joint plant by each member firm as changes in need for money capital in the plant, and in the participation by and proportionality among the several firms, take place. For example, if the same firms share the joint plant on the same proportional basis in the second operating period as the first, but if for one of the reasons mentioned above, more

money capital must be allocated to the plant, the firms will provide the additional capital on the same proportional basis as they provided the original capital for the joint plant. If old firms drop out of the joint activity they will receive in cash their proportionate share of the money capital in the joint plant, and either (1) the size of the plant will be reduced accordingly, (2) the remaining firms will provide additional money capital on a proportional basis to replace the amount withdrawn from the joint plant, (3) additional borrowed capital will be obtained to replace that withdrawn, thus reducing the member firm equity in their joint plant, or (4) new firms will be taken into the joint activity, and will allocate money capital directly to the joint plant to replace that withdrawn. If some firms increase in size over time, thus increasing their proportionate participation in the joint plant, they will be required to allocate additional capital to the joint plant in cash, while those decreasing in size will be refunded part of their allocated capital in cash in order to maintain proportionality.

Another method of maintaining the capital allocated to the joint plant by the participating firms on a proportional basis over time, or at least approximately so, is the formal revolving capital plan so common in cooperative associations. This is true whether capital is allocated to the joint plant by the participating firms through a per unit "deduction" on

volume as an addition to cost, or by deferring the cash payment of patronage refunds. In both cases the greater the amount allocated to the revolving fund in each operating period, and thus the shorter the required period to completely revolve this capital fund, the more closely will complete proportionality be approached among the firms sharing the allocation of capital to their joint plant. Ideally the fund would revolve completely each operating period, so that the deductions or the deferred patronage refunds allocated to the joint plant during the first operating period would serve as member firm capital equity in the plant for the second operating period, and then would be replaced by the deducts or deferred patronage refunds allocated in the second period and be returned to the member firms in cash at the beginning of the third period on the same proportional basis as originally contributed. Ordinarily, however, the operations of the joint plant will be such that participating firms must allocate more capital to the plant than it is practical for them to do with a capital fund which revolves annually. The intertemporal disportionalities are certainly not as serious, even with a five or six year revolving period, as they are when no revolving fund is used and no adjustment is made for changes in the proportionality among the participating firms over time.

With perfect knowledge and certainty the proportionality

concept serves as a guide for the sharing in the economic relationships among firms which arise from their joint operation of a common plant, not only for each operating period, but over time as well. All relationships specific to a given operating period will be participated in only by those firms operating the plant in that period, and shared by them on the same proportional basis as they share the joint plant in that period. All relationships which extend over time, and are therefore joint among several operating periods, will be shared among the groups of firms operating the joint plant in the several operating periods on a basis proportional to the relative size of the plant in each operating period. The proportionate share of these intertemporal relationships participated in by the group of firms operating the joint plant in each period will be shared by the firms within each group on a basis proportional to their relative participation in the joint plant for that period.

B. Imperfect Knowledge and Uncertainty

When the unrealistic assumptions of certainty and perfect knowledge are dropped, it is necessary to introduce certain qualifications into the application of the proportionality rule for the sharing of the multi-lateral relationships among the several firms jointly operating a common plant over time. First of all it may be impossible to determine ex ante

precisely which costs in the joint plant will be joint over time and which will be specific to each operating period. Consequently even though the participating firms plan to pool over time only the fixed costs, the cost of intertemporal risks, and the cost of inventories carried from one operating period to the next, it may develop that, from an ex post viewpoint, some costs specific to only one operating period have been shared by several operating periods. The intertemporal pooling of these plant costs which turn out to be specific to a given operating period does not represent irrational behavior by the entrepreneurs of the participating firms, however, since they cannot anticipate that these costs will be specific to one operating period or in which period they will occur.

To the extent that the percentage future participation in the joint plant by each cooperating firm cannot be anticipated, the proportionate participation in decisions which affect the operation of the joint plant over time is modified also. In the extreme case where nothing can be anticipated regarding the probable increase or decrease in participation of each firm in the joint plant, or even as to probable firms withdrawing from or entering into the joint activity, each participating firm will share in the making of decisions affecting the joint plant over time on a basis proportional to its relative participation in the joint plant in the

current operating period. In the previous hypothetical case, for example, the three firms would participate in these decisions on a 3-3-4 basis, regardless of how their proportionate participation in their joint plant might change over the time necessary to realize the full effects of the decisions. This inability to anticipate future participation in the joint plant may be a clue as to why equal rather than proportional voting has apparently worked so well in the majority of cooperative associations. It is quite possible, in cases where relative future participation in the joint activity cannot be anticipated with any degree of accuracy, that equal participation in decisions which affect the operations of the joint plant over time will more closely approximate intertemporal proportionality among the participating firms than will participation in these decisions on a basis which is proportional in the current operating period. When this is true, and when the majority of the decisions made affect more than one operating period in the joint plant, it is possible that equal voting may represent a better estimate of proportionality over time than voting according to proportionality in the current time period.

With uncertainty and imperfect knowledge it is somewhat easier to keep the capital allocated to the joint plant by the participating firms more nearly proportional through time with a revolving capital fund made up of patronage deductions than one made up of deferred patronage refunds.

Patronage deductions, since they are fixed per unit amount, raise a fund of allocated capital to the joint plant which varies from one operating period to another only as the volume of output in joint plant varies. This means that if the volume of the joint plant is constant the revolving period is constant. Furthermore as volume increases or decreases due to a change in the size of the joint plant, holding the revolving period constant will automatically make the needed upward or downward adjustment in the total capital allocated to the joint plant by the participating firms. Except for occasional modifications due to short run variations in plant volume, the revolving period of patronage deductions can be set up and maintained with a minimum of difficulty, thus maintaining approximate proportionality over time in the sharing of the allocation of capital to the joint plant by the participating firms.

Patronage refunds, unless deliberately maintained at a somewhat constant level by manipulation of the tentative settlement "price" at which products move from the individual participating firms into the joint plant, or vice versa, and/or manipulation of inventories carried over from one period to another, ordinarily are not a fixed per unit amount which can be anticipated in advance. Deferred patronage refunds ordinarily do not raise a fund of capital allocated to the joint plant by the participating firms which, if maintained at a constant level, can be revolved at a constant rate.

In operating periods when patronage refunds are large, the revolving rate of the deferred patronage refunds will be accelerated. The period of time required to completely revolve this capital fund will be increased by patronage refunds which are smaller than normal. Furthermore the size of future patronage refunds cannot be anticipated with certainty so that the proportionate allocation of capital by the participating firms to the joint plant in each operating period is uncertain as well as subject to variability over time. It is more difficult, therefore, to maintain proportionality over time in the sharing of allocation of capital to the joint plant with this type of revolving fund than with a revolving fund of patronage deductions.

In addition to these modifications in the working out of proportionality for sharing the relationships among firms over time in the operation of their joint plant, when uncertainty and imperfect knowledge are taken into account, the sharing of the uncertainty bearing function over time must be considered. Uncertainties extending over time which grow out of the operation of the joint plant, such as technological and operational uncertainties, and price uncertainties of the resources employed in the plant over time, will be shared among the various operating periods on a proportional basis. This is commonly done by creating capital reserves in connection with the joint plant which are not allocated to the participating firms on a proportional basis, but retained in

the joint plant by all participating firms as a group. These reserves are built up by small additions in the per unit costs of operating the joint plant to the member firms--costs of maintaining a continuous operation over time--and are drawn upon only as losses or high costs arise from these uncertainties.[1] These uncertainty bearing reserves are often referred to as "statutory reserves" because they are usually provided for by the enabling statutes.

Because of its nature, it is difficult to anticipate how large this uncertainty bearing reserve should be. Firms ordinarily will not coordinate their economic activities in a common plant for an operation that involves extreme uncertainty, and often may operate the joint plant in a way to minimize uncertainties. Therefore, ordinarily the reserve against uncertainties in the joint plant which exist over time will not be excessively large. If it turns out that too much has been set aside in the uncertainty bearing reserve, it should be revolved on a long time basis, of say fifteen or twenty years, in order to keep the uncertainty bearing proportional over time. If, when a reserve which appears sufficient has been built up, it is maintained and no further

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[1] In purchase and sale cooperative associations additions to these reserves are usually made at the end of each operating period from the "net earnings" of the plant before patronage refunds are allocated. Economically this amounts to the same thing except that the per unit costs of such reserves varies from one operating period to another.

additions are made to it until losses occur, firms participating in the joint plant in past periods are forced to bear more than their proportionate share of the intertemporal uncertainties to the benefit of firms participating in current and future periods. Slowly revolving the reserve minimizes this inequity.

In addition to the uncertainties which extend over time in the joint plant, the participating entrepreneurs may choose to share technical uncertainties and price uncertainties of goods moved through the plant which are specific to given operating periods over time in order to reduce the range of the probability distribution of uncertainty facing each of them, even though it may mean obvious disproportionality over time in an ex post sense. If the technical relationship and the indifference map between stability and efficiency in their firms for the participating entrepreneurs is such that the more stable operations are preferred, it will be economic for them to pool a part of these intratemporal uncertainties over time.[1] This may even be true in cases where the most probable profits to the participating firms in any one operating period are lowered at the same time the probable uncertainties facing each entrepreneur are reduced by pooling over time. In cases where it is not

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[1] See Figure 9.

known, ex ante, in which particular periods most probable profits to the participating entrepreneurs will be lowered and in which they will be raised by intertemporal pooling, this latter decision may not be necessary.

By way of an example of economic pooling of intratemporal uncertainties over time, consider a grain marketing plant operated jointly by several agricultural firms. These firms may anticipate gain by speculating on soybeans held in their joint plant from harvest time until later in the marketing season nine years out of ten, but the one in ten probability of loss might induce them not to carry the soybeans without hedge unless they can intertemporally pool this price uncertainty specific to each operating period. By pooling this uncertainty over time so that it is borne proportionately by several operating periods, each firm can move to a higher stability-efficiency indifference curve, and if anticipations materialize, increase its profits in all operating periods.

Proportionality furnishes the guide for the percentage participation in the economic relationships arising from the operation of a common plant jointly by each of the cooperating firms. This is true over time as well as within each operating period. When imperfect knowledge and uncertainty are considered, it is planned proportionality over time rather than actual realized proportionality which guides the participating firms. Under these conditions some of

these multi-lateral relationships among participating firms may be pooled and shared proportionately over time even though they are specific to a single operating period. This is particularly true of the uncertainty bearing function in connection with the joint plant. In an ex ante sense, by pooling such uncertainties over time, participating firms are often able to lower still further the range of expected dispersions around the most probable anticipated values facing each of them. If this places the cooperating firms on a higher stability-efficiency indifference curve it will represent rational economic action, and may allow entrepreneurial decisions and resource allocation which will provide not only less variable, but also higher average profits over time for them.

VII. PROPORTIONALITY BETWEEN DEPARTMENTS

In addition to sharing the economic relationships arising from the operation of a joint plant within each operating period and over time, cooperating firms typically must face the question of sharing them among two or more departments in the joint plant. In the general case the participating firms will not share the several departments of the joint plant on the same proportional basis. Some of the firms may participate primarily if not entirely in only one or two of several different departments. Others may participate in all of them. Some of the departments in the joint plant may be well-established and of unquestionable value to participating firms in their process of economic production, while others may be new and not yet developed to a size which is large enough to provide maximum economic efficiency. Some of the departments may be characterized by little uncertainty, while the uncertainties in others may be high. The several departments may be closely interrelated, giving rise to many pooled multilateral relationships among the firms participating in the different departments. Accounting and management may determine which departments appear to be highly productive and economic to the participating firms, and which seem to represent a misallocation of resources. Where goods and resources are transferred from one department to another in the joint plant, there may be a definite conflict of economic

interest between the firms participating in the two departments, both as to the movement and as to the accounting "price" of the good or resource at time of transfer. If the addition of a new department is contemplated, there may develop a conflict of interest among the firms participating in the joint plant as to the kind of operation the new department should include, and as to whether or not the addition of the new department represents economic resource allocation.

Suppose the structure visualized in Figure 1 represents the proportionate participation of the cooperating firms in one department of the joint plant; it is probable that these firms will jointly share other departments of the plant on a somewhat different basis. Even if the same firms participate in all departments, proportionate sharing of the specific relationships among the participating firms in one department will likely be disproportionate in other departments. Furthermore not all relationships will be specific to a given department; some will be joint between all of them. The proportionality concept must be extended to embrace the relationships existing among firms jointly operating a common plant of more than one department when they may not share all of these departments on the same basis.

Consideration of the interdepartmental relationships does not modify the concept as developed for sharing the economic relationships of a single department joint plant,

either within an operating period or over time. The cooperating firms within each department will participate in these relationships on a proportional basis, as has been developed in the two previous chapters. The task remaining is to apply the proportionality concept to the sharing of the economic relationships among the participating firms when the plant they jointly share consists of two or more departments which are not necessarily participated in on the same proportionate basis by these firms. This again will be done in two steps--first with perfect knowledge and certainty, and second under uncertainty and imperfect knowledge.

A. Perfect Knowledge and Certainty

Under the assumption of perfect knowledge and no uncertainty, all economic relationships which arise specifically from a given department in the joint plant will be participated in only by those firms sharing in that department, and will be shared by them on the same proportional basis as they share this department. All relationships arising from the operation of the joint plant that are not specific to a given department, but common to several, will be shared among those firms participating in each department on a basis proportional to the fraction of the total operation of the joint plant represented by each of their departments.

As was pointed out in the previous chapter, two important

relationships in connection with the operation of the joint plant, the sharing of the uncertainty bearing function and the sharing of the entrepreneurial decision making function, are ruled out under the restrictive assumption of perfect knowledge and certainty. The sharing of the uncertainty bearing function between departments, and also the necessary modifications regarding the sharing of the decision making function when entrepreneurial decisions are considered, will be developed in the next section. The interdepartmental relationships of concern in this section, then, are the sharing of the economic use of the joint plant, the sharing of management decisions in connection with the joint plant, the sharing of the financial responsibility for the joint plant, the sharing of the costs, including costs of risks, in the joint plant, and the sharing of the economic benefits from the joint plant among the firms participating in each of the several different departments. The group of firms participating in each department will not participate to an extent greater than their proportionate share in any of these relationships, either by sharing in any of the relationships specific to another department, or by sharing more than their proportional part of the relationships which are pooled among those participating in the several departments of the joint plant.

All relationships <u>specific</u> to one department will be

participated in only by the firms sharing this department; they will not be pooled between departments. It would represent a misallocation of resources to do so with perfect knowledge and certainty, because it would require that those firms participating in some departments subsidize those participating in other departments. Only those firms which proportionately share in all relationships with respect to a given department in the joint plant will participate in its use as a part of the economic production carried on by them, and they will share its use on the same proportional basis as they share this department in the plant, as illustrated in Figure 1. They will share the decisions specifically concerning the department on the same basis, and will make them independently of the firms sharing the other departments in the joint plant. As a group they will share the financial responsibilities specific to the department without subsidy from the firms operating any other department. As a group they will bear none of the financial responsibilities specific to any other department. They will proportionately share all fixed and variable costs, including risk costs, and therefore also the economic benefits, specifically in connection with the operation of this department. None of these costs and benefits specific to the department will be pooled with other departments. When goods or resources are transferred from one department to another in the joint plant,[1]

[1]For example, corn transferred from the grain

their market value at the time of transfer will be used as the costs to the department receiving them and the receipts to the department from which they are transferred. Thus all the economic relationships among the cooperating firms which are specific to a given department will be participated in only by those firms involved in the particular department, and will be shared among them on a basis proportional to the basis on which they share this department in the joint plant.

The relationships among the cooperating firms arising from the operation of the joint plant which are not specific to a given department in the plant, but which relate to several departments, must be shared among the groups of firms participating in each department. With perfect knowledge and certainty they will be shared by the departmental groups on a proportional basis; each departmental group of firms will collectively participate in the interdepartmental relationships on a basis proportional to the percentage of the total of each relationship arising from or connected with the operation of their department. As is demonstrated below in the case of joint costs, the firms operating each department will ordinarily as a group assume their full proportionate share of the total of each interdepartmental relationship, not just the marginal relationships arising from the addition

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merchandising department to the feed milling department in a cooperative elevator association.

of the department to the joint plant. If, as new departments are added to the joint activity, the firms participating in the new departments were to share only the marginal relationships, firms participating in the older departments would assume more than their proportionate share of the interdepartmental relationships while those participating in the newer departments would participate less than proportionately in them.

These interdepartmental relationships arising in joint plants of more than one department include decisions concerning the plant which affect the several departments, all costs in the plant which are joint between departments, and the financial responsibility for the fixed and working capital utilized jointly in more than one department. Each interdepartmental decision concerning the joint plant will be participated in by the groups of firms participating in each of the departments, and shared by the groups on a basis proportional to the relative effect the decision will have on each department.[1] In a three department plant operated by four firms jointly suppose, for example, that they share the departments on a 1-1-2-2, 2-3-2-1, and 4-3-2-1 basis respectively. If the joint decision will affect each department

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[1] E.g., the departmental groups of firms would share in a decision regarding the employment of an assistant manager on a basis proportional to the percentage of his time and salary to be allocated to each department.

equally, they will participate in the decision on a 7-7-6-4 basis. If the joint decision will affect only the second and third department, and affect them equally, they will participate in the decision on a 6-6-4-2 or 3-3-2-1 basis. If the decision affects all three departments, but the first twice as much as the other two, they will share the decision on an 8-8-8-6 or 4-4-4-3 basis. If the decision affects the three departments on a 1-2-3 ratio respectively the four participating firms will share the joint decision on a 17-16-12-7 basis, and so on for the many other possible combinations of effects the decision may have on the three departments in this simplified example. With perfect knowledge and certainty, decisions affecting several departments jointly will be participated in by the groups of firms operating each department and shared by them on a proportional basis, as determined by the relative effect each joint decision will have on the several departments.

Each fixed and variable cost, including risk costs, which is joint between several departments in the common plant, will be shared by the groups of participating firms of each department on a basis proportional to the percentage of the total joint cost item utilized in each department. Each department will normally bear its full percentage of each specific total joint cost, as determined by the fraction of the total cost item utilized in this department. The allocation of joint costs between departments will not be

determined by the increment to the total cost of each specific joint item represented by the addition of each department in the joint plant. This is illustrated in Figure 2 for a particular joint cost in a common plant with five departments. The total cost in the plant for this particular joint expense is OEHS = OEFR, which is divided among the five departments as follows: department 1, OALS; department 2, ABKL; department 3, BCJK; department 4, CDIJ; and department 5, DEHI. The participating firms are able to reduce the average cost of this particular expense from OP to OS by having five departments in the joint plant rather than four, because department 5 will bear its full share of the average joint costs, DEHI, rather than only the addition to marginal costs, DEFG.

The fallacy of reasoning that an added department should bear only the addition to marginal joint costs can be seen by imagining in Figure 2 that departments 2, 3, 4 and 5 have been added to the joint plant chronologically. If each were to bear only its incremental addition to joint costs, the costs borne by the second department would be proportionally smaller than the first but larger than the second, and so on for each of the five departments. Firms participating in the first established departments would continue to receive no benefit in terms of reductions in the joint costs borne by them as optimum size, as far as the total joint costs are

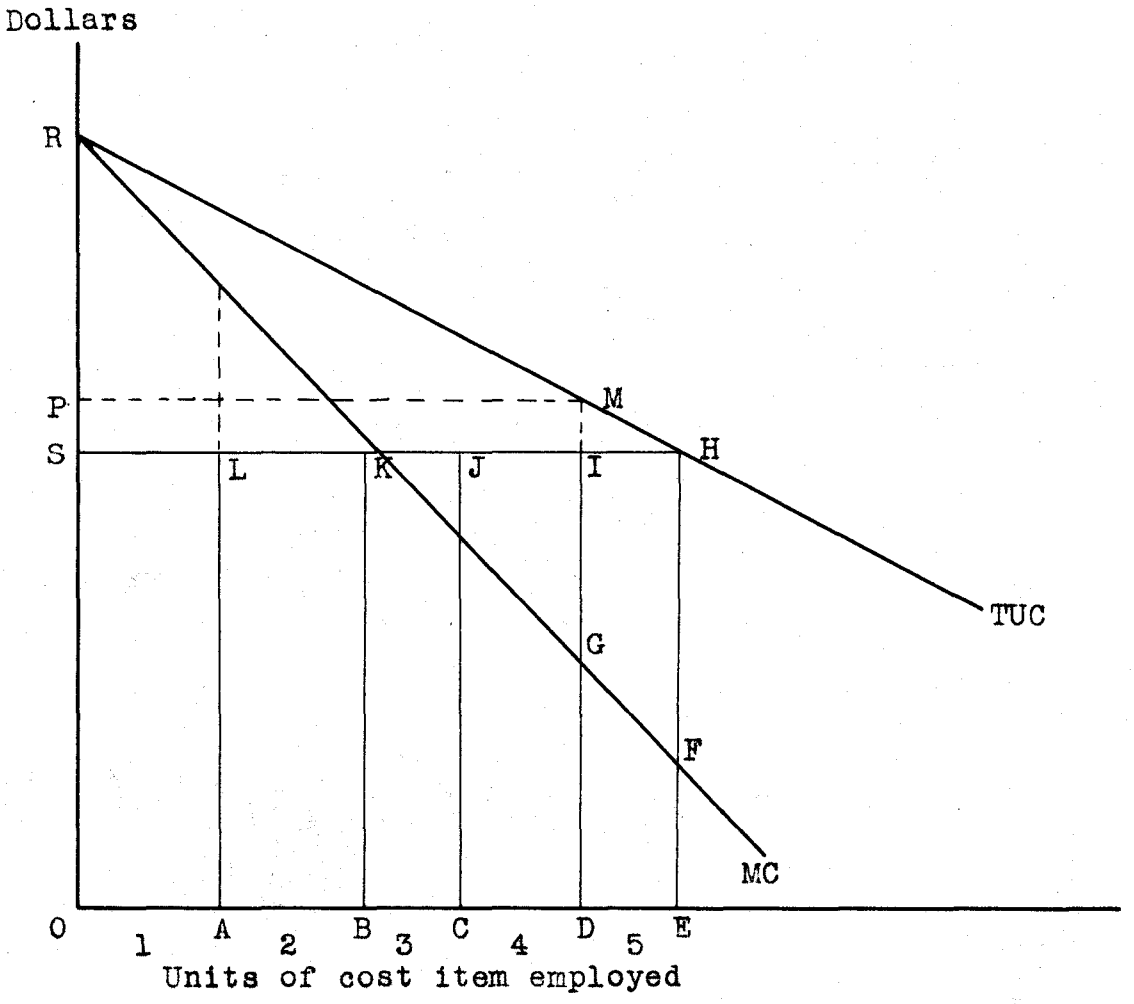

Figure 2. Allocating joint costs.

concerned, is approached, while firms participating in the last established department would receive all such benefits.[1]

It is possible to imagine conditions under which an added department in the joint plant, which represents optimum allocation of resources within the participating firms, would not bear its full proportionate share of the total joint cost in the plant. In the determination of the best production combination in any firm producing more than one product, the effects of an expansion in the output of any product on all marginal expenditures and marginal revenue productivities within the firm must be considered.[2] If all joint costs in the multi-department joint plant taken together decrease substantially with size over the relevant range, as does the specific joint cost in Figure 2, and if joint costs represent a substantial percentage of the total costs in each department, an added or expanded activity in the joint plant which will cause any reduction in average joint costs in the other activities may be economic, even though it will not be able to bear its full proportionate share of the total joint costs. However, the added or expanded activity must represent the best alternative way to achieve the optimum size in the joint

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[1] The determination of optimum size in a multi-department joint plant is discussed in section C of chapter 8.

[2] Cf. Carlson, Sune. A Study in the Pure Theory of Production. Stockholm Economic Studies. No. 9. P. S. King and Son, Ltd. London. 1939. p. 74-91.

plant; if alternatives are available which will cover their full proportionate share of the joint costs, they will ordinarily be more economic than one which will not. Where the expanded activity in the joint plant representing the best alternative will not cover full proportionate joint costs in addition to costs specific to the activity, the added or expanded department will share a fraction of the total joint costs somewhere between the increment in these joint costs and its proportion of the average total joint costs.

Ordinarily a large proportion of the fixed costs in connection with the several departments in the joint plant will be shared jointly by the firms operating the various departments. Such items as depreciation on buildings and fixed equipment, the salaries of the manager and other supervisory employees, rent, insurance premiums, and interest on borrowed capital are examples. Many variable overhead expenses are also often pooled between departments in the joint plant, e.g., advertising costs, clerical expenses, wages of temporary employees, and transportation costs. Except for circumstances causing the modifications discussed above, both the joint fixed costs and the joint variable costs will be shared by the participating firms of each department as collective groups on a basis proportional to the percentage of the total cost items utilized in each department. The allocation of such costs on a proportional

basis is achieved simply by providing for it in the accounting system in the joint plant. If in a three department plant, for example, the manager's time is utilized by these departments on a 3-2-1 basis, the cost of his salary will be allocated among them on a 3-2-1 basis. And with certainty and perfect knowledge each department will be allocated its proportionate share of average total joint cost, not the addition to total joint cost arising from the establishment of the department in the joint plant.

In addition to joint costs, the firms participating in the several departments in the plant will, as groups, share the responsibility for providing fixed and working capital where it is utilized in the various departments jointly. They will ordinarily fulfill a part of this joint responsibility by allocating capital directly to the joint plant and a part of it by providing the security and interest necessary to attract outside capital. The latter method simply adds to joint costs, the interdepartmental sharing of which has just been discussed. No capital utilized specifically by any one department will be provided by cooperating firms not participating in that department; such capital will be allocated to it by only those firms participating in the particular department. The firms participating in the different departments will, as groups, share the allocation of interdepartmental capital directly to the joint plant on

a basis proportional to the relative amounts of this joint capital utilized by each department in the plant--the relative size of each department as measured by the required fixed and working capital for its operation. For example if the required capital allocation by the participating firms to the joint plant for resources employed jointly by the several departments in the plant is $500,000, the firms as collective groups participating in the several departments will share the $500,000 allocation to the joint plant proportionately as the percentage of these joint capital resources is needed and used in each department. With three departments in the joint plant and the first requiring 1/2, the second 3/10, and the third 1/5 of the use of these joint capital resources in the plant, the firms participating in the first department will collectively provide $250,000, those participating in the second $150,000, and those in the third $100,000, the total making up the required $500,000. The firms participating in each department will share this capital in the same proportions as they share that department in the joint plant, of course. Thus a single cooperating entrepreneur of a firm representing .1% of the first department, .2% of the second department and .3% of the third department would allocate $850 out of the total capital of his firm to the joint plant in addition to his proportionate share of the required capital allocation for resources used

specifically in each of the three departments.

With perfect knowledge and certainty the proportionality concept serves as a guide for the sharing in the economic relationships among firms participating in different departments of their joint plant, as well as within each department and over time. All relationships which are specific to a given department will be participated in only by those firms operating the plant in that period, and shared by them on the same proportional basis as they share the department. All relationships which are joint between departments will be shared among the groups of firms participating in the several departments on a basis proportional to the percentage of each relationship arising from or connected with the operation of each department. The proportionate share of these interdepartmental relationships participated in by the group of firms operating each department will be shared among the firms within each group on a basis proportional to their relative participation in that department.

B. Imperfect Knowledge and Uncertainty

As in the case of intertemporal relationships, certain qualifications must be introduced into the application of the proportionality concept to interdepartmental relationships when the assumptions of certainty and perfect knowledge are dropped. The interdepartmental relationships will still be

shared by the groups of firms on a basis proportional to the relative size of each department, but this proportionality will be determined in a "planned" or ex ante sense, rather than in a "realized" or ex post sense. Since proportionality cannot be anticipated with certainty, interdepartmental relationships may turn out to have been shared on a disproportional basis. This is immaterial however; the important thing is that they be shared on the basis of anticipated proportionality. It may be impossible, too, to anticipate accurately what part of each total relationship arising from the operation of the joint plant is specific to the various departments and what part is interdepartmental. The anticipated specific relationships will be participated in only by those firms utilizing the respective departments insofar as it is economic to determine which are specific,[1] and those which are anticipated to be interdepartmental will be shared among the several departments on a proportional basis insofar as it is economic to determine accurate proportional interdepartment allocation.

It may not be possible to tell ex ante precisely which costs in the joint plant will be joint between departments and which will be specific to each department. Or it may

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[1] And, as is pointed out later in this chapter, except where pooling specific relationships between departments is desirable to the participating entrepreneurs because of the reduction of the range of the probability distribution of uncertainties facing each of them individually.

involve such detailed inventory management and accounting that it is economically impractical to do so beyond a certain point. Consequently it may turn out that some costs specific to a given department were shared by several departments. The interdepartmental sharing of plant costs which turn out to be specific to a given operating period does not represent irrational behavior by the entrepreneurs of the participating firms, however, since they either cannot anticipate, or because it is uneconomic to provide the details necessary to more accurately anticipate, whether or not these costs will be specific to one department, and if they are in which department they will occur.

The costs which are anticipated to be interdepartmental will be shared by the groups of firms operating each department on a basis precisely proportional to their relative employment of the items making up the joint costs only if it is assumed that no additional costs are incurred in determining this proportional use of the joint cost item. If costs are incurred in so doing, the determination will be made only up to the point where the marginal cost of making the determination equals the marginal benefit from the accurate allocation of the joint cost. It is quite likely that it will be economically feasible to determine only a range of possible interdepartmental allocations roughly approximating proportionality. For example in a joint plant with three departments, suppose that it is easily and inexpensively

determined that allocating more than fifty percent of the manager's salary to the first department is unfair to the firms operating that department and that an allocation of less than forty-five percent to the department is unfair to those operating the other departments, while the easily determined range for the other two departments is twenty-five to thirty percent and twenty to thirty percent of the total of the manager's salary, respectively. It will be economic to arbitrarily select some allocation between these limits, say 47½% - 27½% - 25% respectively, rather than incur extra expenditures to determine more precisely where division should be made if the cost of making a more accurate allocation is relatively high and the arbitrary division is reasonably accurate. If the manager's salary is $10,000, the actual division 48% - 26% - 26%, and the cost of determining and making the accurate division $1,000, for instance, the firms operating the three departments as groups would be respectively $530 - $110 - $360 worse off if the accurate interdepartmental division were to be made. With uncertainty and imperfect knowledge, participating firms will strive only for such degree of accuracy in the allocation of joint costs between departments as can be achieved economically. This is also true in regard to the value of goods and capital resources transferred from one department to another in the joint plant. It will only be economic to charge the department receiving the good or resource its actual market value

at time of transfer when the marginal cost of making the accurate determination of value is not more than the marginal benefit derived from making the accurate determination. If the value of the good or resource at time of transfer can be estimated fairly accurately, and the cost of making a more precise determination of value is high, it will be uneconomic to make the more precise determination. By eliminating such costs as those of transportation, merchandising and advertising, by interdepartmental transfer as compared to outside purchases and sales, the transaction may return a net benefit to both the firms of the transferring department and those of the receiving department, even though one group benefits slightly at the expense of the other from estimating rather than in accurately determining the value at time of transfer.

It has been seen that with certainty and perfect knowledge interdepartmental joint costs are shared proportionately by the respective departments, with the firms operating each as a group bearing their respective share of average joint costs. This is ordinarily true for new departments in the joint plant as well as previously established ones (see Figure 2). With uncertainty and imperfect knowledge, the costs which are anticipated as joint between departments will be shared proportionately, insofar as it is economic to determine proportionality, by the several departments. Each department will still normally bear its proportionate share

of the average joint costs rather than per unit marginal joint costs associated with that department. New departments will usually not be added unless they are anticipated to be productive enough to cover total specific costs plus their proportionate share of the average total joint costs. This is true even where the average total joint cost curve is falling over the entire relevant range, unless the addition of a department will lower average total joint costs enough to make it economic to the participating firms to subsidize the added department with the other departments in the joint plant. And even in this case such a procedure will not represent optimum resource allocation in the participating firms if it is possible to add other departments or expand existing ones in the joint plant which can be expected to cover their proportionate share of average total joint costs as well as total average specific costs.

With uncertainty and imperfect knowledge, it is altogether possible that the entrepreneurs of the firms operating the joint plant may consider it in their best long run interest, where joint costs are decreasing throughout the relevant range, not to burden a new department with its full share of overhead costs during the period in which it is becoming established. This is altogether different, however, from the case where the proposed new department can only be justified if it bears only the amount added to total joint costs. If the new department can, from the beginning, pay

its specific costs plus the addition to total joint costs (DEFG in Figure 2) the new department will not be a liability in the joint plant while it is becoming established since total joint costs to the other departments will be unchanged (FHIG = SIMP in Figure 2). And as soon as the new department is able to bear its proportionate share of average total joint costs, all participating firms will benefit from the addition of the new department, whether or not they participate in it, since overhead costs per unit will be reduced (from DM to DI in Figure 2).

Although with uncertainty and imperfect knowledge the decisions in the common plant which affect several departments jointly are entrepreneurial decisions, the decision making will also be shared by the firms participating in each department proportionately as the decision affects the operation of each department, except that this proportionality must be determined ex ante at the time the decision is made. Since the decision is made ex ante, anticipated proportionality regarding the relative effects of the decision on the several departments, rather than actual proportionality, is relevant. To the extent that the percentage effect of the decision on each department cannot be anticipated, the proportionate participation in decisions which affect the operation of the several departments jointly is approximate rather than accurate. In the extreme case where it is anticipated that the decision will affect the several

departments jointly but nothing can be anticipated regarding the proportional effects of the decision, the firms operating each of the departments will as groups participate equally in the entrepreneurial decision, as the best approximation to proportionality. Whenever the proportional effect of the decision on the various departments can be anticipated to any extent, proportionality, rather than equality, is the basis upon which the decision will be shared interdepartmentally.

With uncertainty in the picture, the proportionate utilization of joint capital resources in the common plant by the various departments is also anticipated rather than given. This capital will be provided by the groups of firms participating in each of the departments and shared on a basis proportional to the anticipated relative use to be made of the joint resource in each department. Ordinarily, however, it will be possible to quite accurately anticipate the proportionate utilization of joint capital resources in the common plant by each department over short periods. As anticipated proportionality changes over time, the relative amount of total joint capital contributed by the firms operating each department in the joint plant can be adjusted accordingly.

The uncertainty bearing relationship between the firms operating each of the departments in the joint plant was ruled out by assumption in the previous section. In general those uncertainties, such as price and technological

uncertainties, which are specific to a given department, will not be pooled between departments, but instead will be borne within the department and shared proportionately by the firms participating in that department. Uncertainties, such as operationed uncertainties, which are interdepartmental will be shared by the groups of firms participating in each of the departments according to the anticipated fraction of the total joint uncertainties arising from the operation of each department. Often the best anticipation of this will be the relative size of the operations of each department, but where it appears that greater uncertainty is associated with the activity of one department than another this will also be taken into account. Interdepartmental uncertainties, along with intertemporal uncertainties, are commonly shared proportionately among the different groups of firms by means of capital reserves retained by all participating firms as a group and maintained as a financial cushion against uncertainties to be drawn on as the need arises. These reserves are built up by small additions to costs in all departments of the joint plant, the relative amount in each department based on the anticipated proportionate amount of joint uncertainty which is associated with each department.

If the indifference map of the participating entrepreneurs is such that they place a high value on stability relative to efficiency (see Figure 9), and if the anticipated specific uncertainties arising from each of the departments

in the joint plant are relatively uniform in degree, it is likely to be economic to the participating entrepreneurs to pool some of the specific uncertainties between departments, even though it results in interdepartmental disproportionalities in an ex post sense. Mayhew[1] has apparently drawn on a case where these conditions are met when he argues the superiority of single pooling over multiple pooling. In the single pool both price uncertainties and costs specific to each department as well as those which are interdepartmental are pooled among departments and shared proportionately by them. Such a policy will be economic to cooperating firms only under these special conditions, however, and cannot be recommended in the general case because of the uneconomic disproportionalities which are likely to result between firms participating in different departments in the joint plant.

The proportionality concept applies to the sharing of all economic relationships among cooperating firms arising from their operation of a common plant jointly. This is true between departments and over time as well as within a given department and operating period. With uncertainty in the picture, these relationships are shared by participating firms on the basis of anticipated proportionality. Specific

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[1]Mayhew, Wayne E. Single and Multiple Pool Accounting for Cooperatives. In American Cooperation; 1948. p. 219-229. American Institute of Cooperation. Washington, D. C. 1949.

relationships will not be pooled over time or between departments unless it is economic for the participating entrepreneurs to pool them in order to reduce the uncertainties facing each firm individually.

VIII. OPTIMUM PLANT SIZE

The types of economic activity jointly conducted by several firms in a common plant usually require a relatively large operation, either to achieve best proportionate combination of inputs, or because of increasing returns to scale, or both. If the long run average cost curve in the plant is horizontal over the entire range of volume, at least in a static sense the participating firms would have had no incentive, except a possible monopoly influence over their markets, to set up the joint plant. Each firm could set up and operate its own plant to perform for it the same function performed in the joint plant with no sacrifice of productive efficiency. In the absence of an opportunity to influence their markets by combined effort, if it were possible to do this, firms would function independently rather than coordinate a part of their activities in a common plant, because of what Emelianoff calls the "centrifical forces" working against such coordination.[1] Where the long run average cost curve is decreasing over a considerable range for a part of the total economic function, or contemplated function, of several firms, however, by coordinating this part of their activities and functioning jointly through a common plant, they can increase their economic

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[1] Emelianoff. op. cit., p. 106.

efficiency by achieving optimum size in the plant. At the same time they do not sacrifice any efficiency by moving into the range of increasing long run average costs in their other activities, since they function individually and independently with respect to them. Furthermore the individual firms retain their individual identity and sovereignty, which they would not do if they were to merge in order to gain the economics of size in this particular function.

Size rather than scale is used throughout this discussion because the nature of the long run average cost curve may reflect both the nature of returns to scale and different optimum proportionate combinations. The long run average cost curve is obtained by combining the points reflecting the most favorable input combination for every output. It is of little concern for the present discussion whether the resulting long run average cost curve is a true scale line, a proportionality line, or some combination of the two. It is the relationship between long run average cost and volume, not the causes of this relationship as such, which determines the optimum joint plant size.

The size of the joint plant will be a function of two variables--the number of firms participating, and the size of each participating firm.[1] If either of these factors is constant, the size of the joint plant will be a direct

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[1]Participating firm size again as defined only by those activities in the firm integrated with the activities of the joint plant.

function of the other. The determination of the optimum size of the participating firms, taking into consideration that part of each included in the joint plant as well as that part outside of it, is discussed in the following chapter. It will be assumed here that each participating firm has individually achieved optimum size and resource allocation when the total activity for each firm, including its proportionate share of the joint plant, has been taken into account. As portrayed in Figure 1, the optimum size for each firm is not necessarily assumed to be equal to that of all other participating firms. Having by assumption determined the optimum size of each participating or potentially participating firm, the determination of the optimum size of the joint plant will specify the number of participating firms in the plant. The optimum plant size will be realized by securing the necessary number of participating firms in the cooperative association at the time it is formed, and can be adjusted in the long run as conditions affecting the economics of size change, by inducing new firms to participate, or by failing to replace firms which cease participation, as the case warrants.

As has been pointed out, however, the decision to participate in the joint activity and to withdraw from it is made individually by the entrepreneurs of the cooperating firms rather than by the participating entrepreneurs coordinately, except that, as a cooperating group, they can limit

participation in the joint plant if desirable. Where the optimum plant size is relatively large the associated activity will have to represent an economic resource allocation to a substantial number of firms, rather than only a few, because firms cannot be induced to participate against their own best economic interest regardless of how much plant efficiency could be improved by their participation. And even when participation in the joint activity is in their best interest, some firms may not participate because of imperfect knowledge and lack of entrepreneurial ability. The cooperating firms may be able to induce such firms to participate through informational and educational efforts, and may justifiably incur costs to do so if the participation of such firms will increase plant efficiency sufficiently.

Because of the fact that the joint plant is an integrated part of each of the participating firms, the optimum size of the plant will not necessarily be identical to that of a firm performing the same economic function under the same circumstances. Products and resources moving from the joint plant to the participating firms, or vice versa, do not change hands, but are simply reallocated within the firms. Where the output of the individual plants of the participating firms is input to their joint plant, the cost function in the joint plant includes no cost for the raw products which are processed and marketed in the joint plant. The quantity of such products supplied to the plant is not determined in the

market place directly, but by the sum of the individual entrepreneurial decisions by the participating entrepreneurs, considering both the operations of the joint plant and their individual plants, as to how much of these products will be produced in each firm. The long run average cost curve in the joint plant is therefore derived directly from the physical production function as it is affected by volume. This technical production function in the plant will take into consideration the input-output relationship as affected by volume in the processing, storage, merchandising and transportation of the products (both from the participating firms to the joint plant and from the plant to outside firms providing the market for the plant output). The long run average cost curve in the marketing plant will consider only the costs involved in such relationships and not the supply price of the product inputs as affected by volume. The low point or range in the long run average cost curve in the joint plant will be at the same output as the low point in the long run average cost curve in a firm in the same circumstances, unless the supply curve of the product input to such a firm is perfectly elastic, but will be at a larger volume.

Where the output of the joint plant is input to the individual plants of the participating firms, the cooperating entrepreneurs must consider the product supply curve facing the joint plant, but as a group they do not face a demand

curve in the joint plant since products do not change hands as they move from the joint plant to the participating firms. The quantity of such products demanded from the plant is not determined in the market place directly, but by the sum of the individual entrepreneurial decisions by the participating entrepreneurs, again considering the operations of both the joint plant and their individual plants, as to how much of these products will be utilized in each firm. In this case the long run average cost curve in the joint plant will take into account costs involved in the physical production function and also the long run product supply curve faced in the joint plant. The optimum plant size will be defined directly by the long run average cost curve, however. The elasticity of the long run demand curve will not be a factor, since the demand for the output of the plant is determined by the sum of the individual decisions of the participating entrepreneurs, and is given insofar as the joint plant is concerned.

When the output of the individual plants of the participating firms is input in the joint plant, the joint plant will be referred to as a marketing plant. When the output of the joint plant is input to the individual plants of the participating firms, the joint plant will be referred to as a purchasing plant. Examples of joint marketing plants include all agricultural marketing cooperatives, such as grain elevators, creameries and fluid milk association cotton gins, livestock marketing associations, canning factories, soybean

processing plants, citrus and small fruit marketing associations, tobacco marketing associations, vegetable and nut marketing associations, and wool marketing associations; fisherman's marketing associations; marketing associations of manufacturers; and marketing associations of transportation companies, such as the Railway Express Agency. In these associations the joint plant is integrated with and operated as a part of the total operations of the firms operating individual plants to produce the raw material product inputs for the joint plant. Examples of joint purchasing plants include all agricultural purchasing cooperatives, such as petroleum associations, general farm supply associations, feed and seed associations, fertilizer associations, rural electric associations, farm insurance associations; retail merchants' wholesale purchasing associations, such as grocers' wholesale associations, hardware wholesale associations, and druggists' wholesale associations; manufacturers' supply purchasing association; and consumers' purchasing associations. In these associations the joint plant is integrated with and operated as a part of the total operations of the firms which operate individual plants that utilize the finished product outputs of the joint plant. In both types of joint plant the opportunity to gain economies of size, as a result of both technical production economies and opportunities to influence the markets facing the firms, and the opportunity to reduce the range of uncertainties

facing the individual entrepreneurs are the two important factors motivating the integration through coordinate action rather than by each firm individually.

A. Optimum Size in the Joint Marketing Plant

The optimum size in the joint marketing plant, from the standpoint of maximum economic efficiency in the participating firms, is defined by the relationship between two functions in the joint plant. These two functions are the long run average total unit cost curve and the long run average revenue curve. The long run average costs in the joint marketing plant will include all costs of processing, storage, merchandising, packaging, advertising and transportation in connection with the products marketed through the joint plant. Such costs will have some characteristic regression on volume, depending on the nature of the technical production functions in the plant and the supply price of resource inputs to the participating firms as a group. Unless this regression is a horizontal straight line over the whole range, some optimum size or optimum size range for the plant operations will be defined from the standpoint of minimizing long run average total unit costs.

This minimum point or range in the long run average total unit cost curve in the joint plant will be at the same volume as the long run average cost curve for a <u>firm</u>

performing the same economic function as the joint plant under the same circumstances only in the special case where the long run raw product supply function facing such a firm is perfectly elastic. The long run average cost curve in the joint plant will be lower than the similar curve for a firm performing the same function throughout the range by an amount equal to the supply price of the raw products to this firm. The amount will be a constant when this supply curve is perfectly elastic, but will be an increasing function of volume when the long run average expenditure curve for these products to such a firm has any positive slope. If the latter is the case, the long run average total unit cost curve in the joint plant will never reach its minimum point as soon (at as small size) as will the long run average cost curve of a firm in the same circumstances.

These characteristics are visualized in Figure 3. The solid line curves represent those relevant in the joint marketing plant while those of broken lines represent the relevant curves in the firm performing the same function. The prime notation letters refer to the firm while those which are not prime refer to the plant. In Figure 3A the long run average cost curve in the marketing plant reaches its minimum at output (plant size) OQ, and the long run average cost curve in the firm reaches its minimum at this same output, OQ, because the long run supply curve of raw products to the

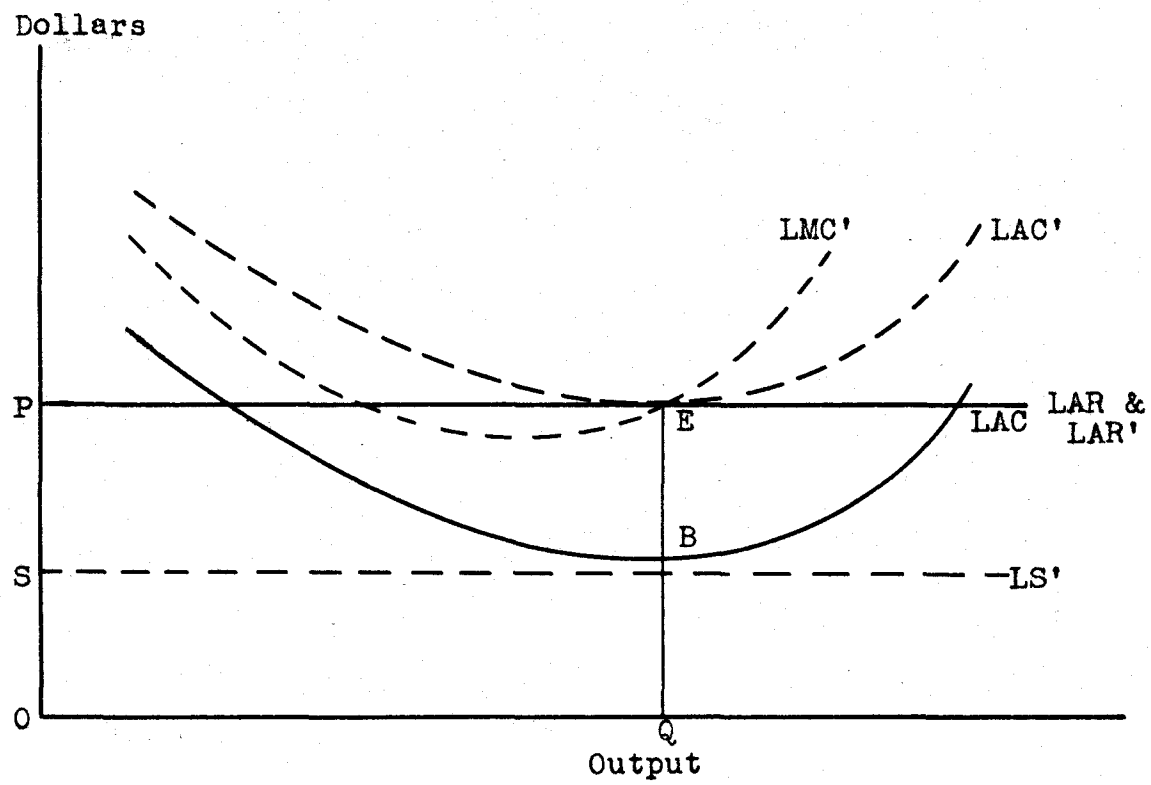

Figure 3A. Marketing plant. Long run equilibrium under competitive conditions.

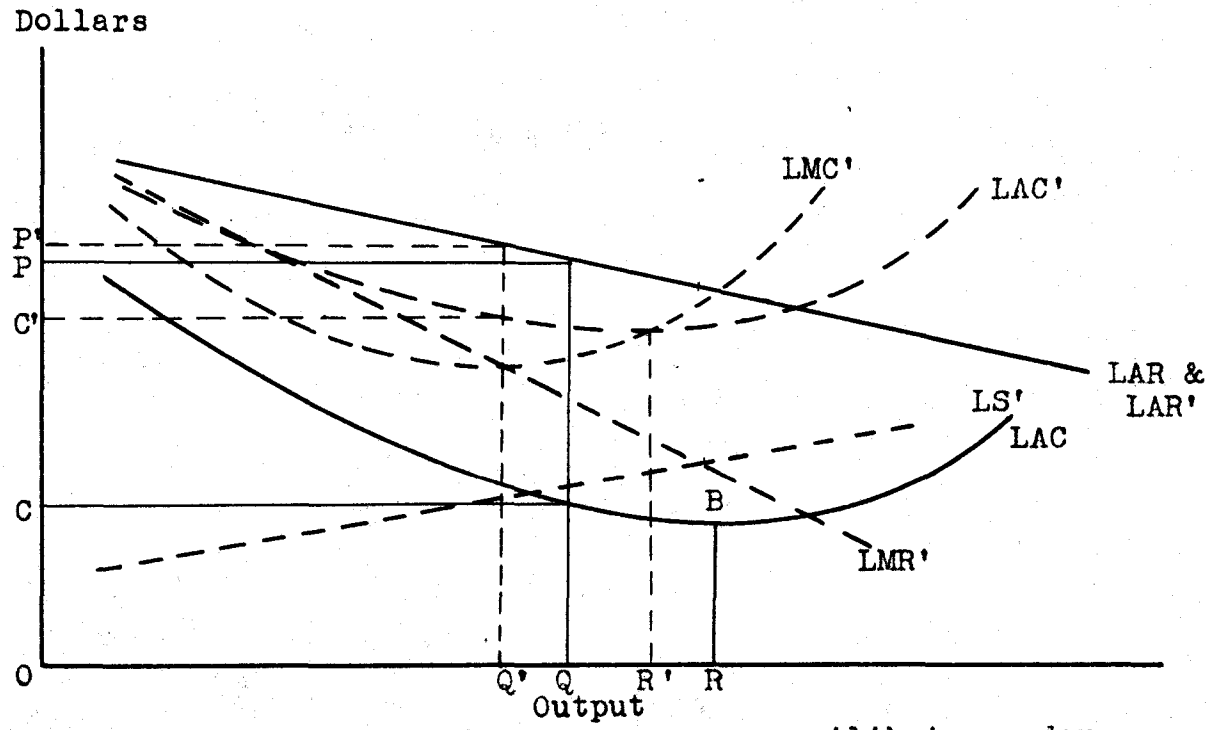

Figure 3B. Marketing plant. Long run equilibrium under monopolistic conditions.

firm, LS', is perfectly elastic throughout. LAC' is equal to LAC plus OS, which is a constant.

In Figure 3B, however, LS' is positively sloped so that the sum of the LS' function and the LAC function gives the LAC' function which reaches its minimum at a smaller long run output (size) than does the LAC function. In this case the size, OR, which minimizes the long run average cost in the joint marketing plant is larger than the size, OR', which minimizes the long run average cost in the firm under the same conditions.

The most economic size for the joint marketing plant is not defined by the long run average cost curve alone, however. Under the assumption that each participating entrepreneur has arrived at the optimum allocation of resources in his total firm, including that part in the joint plant, and has therefore determined the volume represented by his participation in the joint plant, the cooperating entrepreneurs will strive to obtain the number of participating firms necessary to give the joint plant the size which will maximize the contribution of the joint plant to the profit of each participating firm. The size at which this optimum economic efficiency will be achieved in the joint marketing plant depends not alone on the long run average cost function, but instead upon the relationship between this function and the long run average revenue function.

The joint marketing plant will be of optimum size when

the long run per unit net return in the plant is at a maximum, because at that volume the net contribution to the income of each and every participating firm, be it large or small, will be at a maximum. At this size of operations, which is achieved, remember, by the participation of the optimum number of firms, the cooperating entrepreneurs will receive the maximum per unit realized price for the products produced in their individual plants and marketed through their joint plant. By maximizing this net realized price, the participating entrepreneurs maximize the addition to their individual net incomes. This is true, since the participating firms by assumption are individually in equilibrium, regardless of the number of units produced in each of their firms and marketed through their joint plant, and regardless of the average production costs in each of their individual firms.

By way of illustrating this significant point, suppose that the long run average per unit net return to the participating firms for the products marketed through the joint plant is maximized at one dollar by the optimum size of one million units of output in the joint plant. The contribution of the plant to the profit of each participating firm will be at a maximum at this output. This is true for an individual participating firm producing ten units; it is true for one producing ten thousand units. It holds equally true for a participating firm with an average production cost of nine cents and one with an average production cost of ninety cents.

If the size of this joint marketing plant is either contracted or expanded from this one million units of output, so that the average net return is reduced to ninety-nine cents, the profits of all participating firms will be correspondingly reduced.

It is of course possible, and even likely, that the nature of the long run average cost curve and the long run average revenue curve in the joint marketing plant may be such that there is no one optimum plant size. There may be a wide optimum size range. This is particularly likely to be true where the long run average revenue curve is perfectly elastic. In such cases the cooperating firms will strive to obtain a size in their joint marketing plant somewhere within the optimum range. Judging from the experience of cooperative associations in practice, where the participating firms are faced with capital rationing, uncertainties, imperfect knowledge, and indifference by some of the participating entrepreneurs, they will probably strive for the minimum rather than a larger optimum size, at least at the primary level.

The participating entrepreneurs of a joint marketing plant, then, seek to obtain and maintain a sufficient number of firms in the associated activity to give a volume in the joint plant which will maximize the vertical distance between the long run average cost curve and the long run average

revenue curve facing them in their joint plant.[1] The long run average revenue curve facing the joint marketing plant will be identical to the long run average revenue curve facing a sovereign firm in the same circumstances. If products marketed through the joint plant constitute a sufficiently small part of those for the industry so that the participating firms cannot influence the price of these products, and in the absence of product differentiation, this long run average revenue curve will be perfectly elastic, and the low point in the long run average cost curve will represent the plant size at which per unit net revenue from the operations of the joint marketing plant will be at a maximum. If the average expenditure function for the raw product inputs to a firm performing the same function as the joint plant is perfectly elastic, the optimum size of the joint plant and the optimum size of a firm in the same situation will be identical under these conditions.

Where the output of the joint plant is a differentiated product, or where it represents a large enough part of the total industry output so that the participating firms can influence the price of the product, the long run average revenue curve to the plant will be negatively sloped. In such case the optimum plant size will be at an output

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[1] Cf. Phillips. op. cit., p. 72-80.

somewhat smaller than that which minimizes the long run average costs. The optimum will be that size which maximizes long run per unit net revenue from the plant which will be at the output where the vertical spread between long run average cost and long run average revenue in the plant is greatest.[1] This will not necessarily be at the same output as the optimum size for a firm in the same situation, although the optimum size for the two is likely to correspond quite closely. Not only will the sovereign firm have a different long run average cost curve, but in order to maximize profits, the optimum firm size will be at the output where the long run marginal cost curve intersects the long run marginal revenue curve in the firm. The participating firms do not seek to maximize profits in the joint marketing plant as such but rather to maximize their profits individually, which they will achieve at the joint plant size which maximizes average net return, rather than total net revenue, from their joint plant.

These conditions are also visualized in Figure 3. In Figure 3A the participating firms maximize their profits by maintaining the size OQ in their joint marketing plant which maximizes average net revenue, BE, from the plant. Since the

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[1] Mathematically where the first derivatives of these two functions are equal.

long run average revenue curve is a horizontal straight line, this will be at the plant size OQ, which minimizes long run average costs. A firm under the same circumstances faced with a perfectly elastic marginal expenditure curve for its raw product input, LS', will also operate at the size OQ because at this output long run marginal cost equals long run marginal revenue in the firm. If LS' is positively sloped, such a firm will reach its equilibrium output somewhere to the left of OQ.

In Figure 3B the participating firms are faced with a negatively sloped long run average revenue curve in their joint marketing plant. They maximize average net return from the plant, CP, at the plant size OQ where the long run average revenue curve and the long run average cost curve are the greatest vertical distance apart. A firm under the same circumstances faced with the positively sloped average expenditure function, LS', will reach its equilibrium size at output, OQ', which maximizes total net revenue. This output will be defined where the long run marginal cost curve intersects the long run marginal revenue curve in the firm.

Figures 3A and 3B of course represent only two cases out of many possible conditions in the industry in which the joint plant is operated. Conditions may be competitive on the demand side so that the long run average revenue curve is perfectly elastic and monopsonistic on the supply side so that the long run supply (average expenditure) curve for raw

products facing a firm in the same situation as the joint plant is positively sloped. Or conditions may be monopolistic on the demand side so that the long run demand curve facing the participating firms in their joint plant (and a firm in the same situation) is negatively sloped and competitive on the supply side so that the average expenditure function to the firm is perfectly elastic. Vast differences in the degree of monopoly and monopsony are also possible.[1]

It has been seen that the size of joint marketing plant which maximizes the profits of all participating firms is that size which maximizes the long run average net return from the joint plant. This will be at that plant output which equates the slope of the long run average total unit cost curve and the slope of the long run average revenue curve in the plant. The relevant long run average cost curve in the joint marketing plant is net of the supply price of the raw product inputs, since these are not obtained in the market, but produced in the individual plants of the participating entrepreneurs. Under the assumptions made, the optimum plant size is obtained only be securing the optimum number of participating entrepreneurs in the joint activity.

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[1]Degree of monopoly in the Lange sense. See Lange, Oscar. Price Flexibility and Employment. Cowles Comm. for Res. in Econ. Monograph No. 8. Principia Press, Inc. Bloomington, Indiana. 1944. p. 41.

B. Optimum Size in the Joint Purchasing Plant

The optimum size in the joint purchasing plant, from the standpoint of maximum economic efficiency in the participating firms, is determined by only one function in the joint plant, and that is the long run average total cost function. The participating entrepreneurs as a group do not face a demand function for the output of their joint purchasing plant, since they set up the joint plant as a proportionate part of each of their firms to manufacture, process or procure raw products or specific capital resources needed in their individual production operations. There is no average revenue function in the joint purchasing plant because its output does not move into the market to be sold to outside firms, but instead moves from the joint plant to the separate firms of the individual participating entrepreneurs without changing hands in the economic sense.

The participating firms individually determine, and have determined by assumption, the optimum number of units of the joint plant output needed to supply the aggregate input in their individual firms. The participating entrepreneurs have each made this determination considering the total net per unit cost of such input obtained through their joint purchasing plant and the productivity of this input in each individual firm. The optimum plant size is achieved by securing the number of participating firms which will provide the volume

necessary to minimize the average total unit cost of the output of the joint purchasing plant to the participating firms. Starting with each participating firm in production equilibrium, the joint purchasing plant size which minimizes this average total unit cost of the plant output will maximize the profits of each participating firm, regardless of the number of units used, or the marginal productivity of this plant output, in each participating firm.

An example may again be used to illustrate. Suppose that in a given joint purchasing plant the optimum size is an output of five hundred thousand units and the average total unit cost is one dollar at this output. The plant at this size will render the maximum contribution to the profit of the participating firm using five units of the plant output and the one using five thousand units alike. This is equally true for a participating firm in which the average productivity of this output of the joint plant is one dollar and one cent and one where the productivity is one dollar and ninety-nine cents. If the size of the joint purchasing plant is either expanded or contracted from this five hundred thousand units of output so that the average total per unit cost is increased to a dollar and one cent, the profits of all participating firms will be reduced accordingly.

In order to compare the long run average costs in the joint purchasing plant with those in the joint marketing plant, the joint purchasing plant costs may be broken down

into costs of operating the plant, and the cost of raw product inputs in the plant. The long run average operating or factor cost function in the joint purchasing plant is the same sort of cost curve as the relevant long run average cost curve in the joint marketing plant. It will include all costs of procurement, assembly, storage, processing, and transportation in connection with all products purchased through the joint plant, and will again have some characteristic regression on volume, depending upon the nature of the technical production functions in the plant and the supply price of resource inputs to the participating firms as a group.

The long run average raw product input in the joint purchasing plant will be the long run supply function of such products facing the participating entrepreneurs in the joint plant. This supply price may be constant to the joint plant over all units of volume, as it would be under competitive conditions, or it may be an increasing function of volume, as it would be under monopsonistic conditions. It may even be a decreasing function of volume over a limited range because of opportunities for quantity discounts and similar concessions, where the participating firms face monopolistic selling of such products.

The relevant long run average cost curve in the joint purchasing plant, and also for a sovereign firm in the same conditions, is the sum of the long run average total factor cost function and the long run supply function of the product

inputs faced in the joint plant. The participating entrepreneurs of a joint purchasing plant seek to obtain and maintain a sufficient number of firms in the associated activity to give a volume in the joint plant which will minimize the long run average total unit cost function in the joint plant.[1] This will be at the same output as a firm in the same circumstances when the long run demand curve facing the firm is perfectly elastic, but the optimum size for the two will not necessarily be at the same output when the long run demand curve facing the firm is negatively sloped.

These conditions are visualized in Figure 4. The same scheme of notation that was used in Figure 3 is used here. In Figure 4A the optimum size for the joint purchasing plant is at the output OQ where the long run average total cost curve is at its minimum. In this case the long run supply curve for the raw products used in the joint plant is perfectly elastic so that the low point in the long run average factor cost curve is also at its minimum at this point. The average revenue curve for the firm in the same situation is horizontal in this case so that output OQ also represents the optimum firm size. Both the participating firms in the joint purchasing plant and the sovereign firm will pay suppliers of the raw products the price QB per unit for OQ units in this case.

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[1] Cf. Phillips. op. cit., p. 80-84.

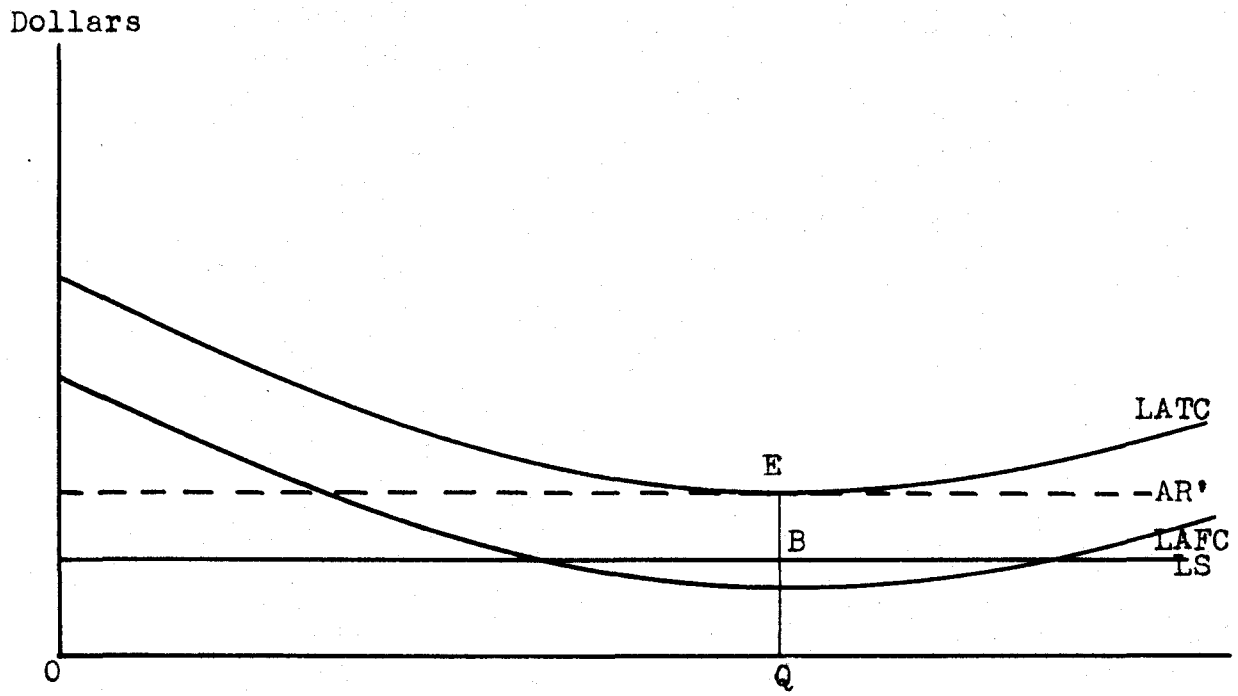

Figure 4A. Purchasing plant. Long run equilibrium under perfect competitive conditions.

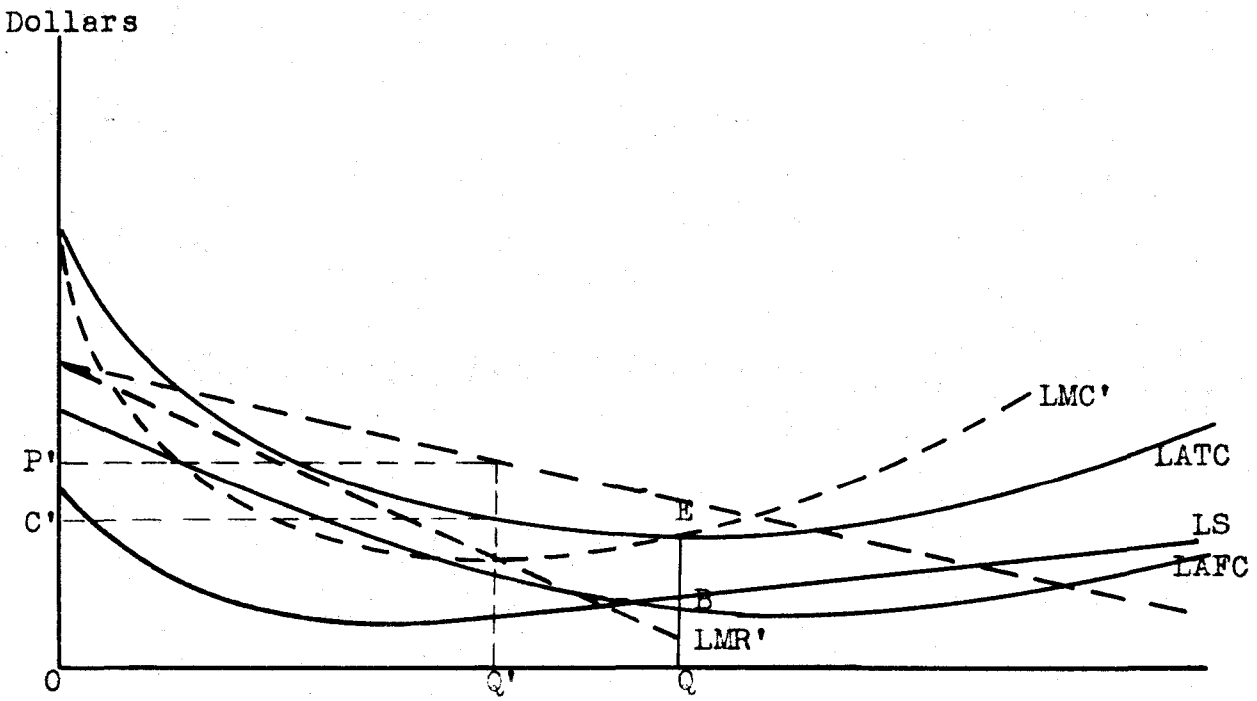

Figure 4B. Purchasing plant. Long run equilibrium under monopolistic conditions.

In Figure 4B the optimum size for the joint purchasing plant is also at the output OQ where the long run average total cost curve is at a minimum. This optimum size is smaller than the output at which the long run average factor cost curve reaches its minimum because the long run supply curve for the raw products, while downward sloping over a limited range, is upward sloping over the relevant range. At this optimum the average total unit cost to the participating firms for the output of the joint plant is QE, of which QB goes to the suppliers of the raw product input. The firm under the same circumstances is in this case assumed to be faced with a negatively sloped long run average revenue curve. The optimum firm size is at the output OQ' where the long run marginal cost curve intersects the long run marginal revenue curve from below. The firm sells its output for a per unit price OP' and operates at a total unit cost of OC'. It can be seen from these diagrams that the purchasing plant size which maximizes the profits of the participating firms is necessarily at the same output as the optimum size for a firm in the same situation only when the demand curve facing the firm is perfectly elastic.

In summary then, the size of the joint purchasing plant which maximizes the profits of <u>all</u> participating firms is that size which minimizes the long run average total unit cost function in the joint plant. This average total cost includes both plant operating costs and costs for the raw

product inputs. There is no demand curve facing the participating entrepreneurs in the joint purchasing plant since the plant output is not marketed to outside firms from the plant, but moves directly into the individual plants of the participating entrepreneurs.

C. Optimum Size in the Multiple Department Plant

So far the optimum size of the joint marketing plant and the joint purchasing plant has been considered in the case where it is economic to the participating firms to have only one department in their joint activity. It is entirely possible, however, that the nature of the production activities in the individual firms of the participating entrepreneurs is such that several departments in the joint plant can be effectively integrated with the individual activities of these firms. So long as the economic relationships among participating firms are shared proportionately within and between departments, firms participating in one department need not necessarily participate in other departments. Every firm will participate only in those departments, and only to the extent in each of them, where it represents optimum resource allocation within the firm to do so. The determination of the optimum size for each department in a multiple department joint plant is made on the assumption that each participating firm has achieved optimum resource allocation

considering the entire activities of the firm, including those within the joint plant as well as those outside of it. The optimum size for each department, and for the joint plant as a whole, is achieved by securing the number of participating firms in each department which is necessary to achieve this size.

Because of indivisibilities of certain inputs, and because of inefficiencies in the use of certain resources for other reasons, a single department joint plant may be unable to achieve the degree of efficiency which is possible in a multiple department joint plant. In both the joint marketing plant and the joint purchasing plant of more than one department there is often an opportunity to share certain long run average joint costs between departments. By making fuller use of certain inputs this usually gives rise to greater economic efficiency than is possible in a single department plant. If there is no opportunity to share some of these costs and inputs interdepartmentally in the multiple department plant, such a plant has little economic advantage over one with a single department. Furthermore, unless the long run average joint cost curve is a decreasing function of volume over a range greater than the optimum for a single department, the participating firms can gain little economy from better input combinations by expanding the size of the joint plant beyond one department. It is probable, however, because of indivisibilities and the opportunity for more

nearly best proportionate combination of inputs at larger sizes, that the long run average joint cost curve will be downward sloping over a substantial range.[1]

The participating entrepreneurs of a multiple department joint purchasing plant will achieve the optimum size of their plant when a sufficient number of departments, each of optimum size, has been added to minimize the long run average total unit joint cost in the plant. The optimum size of each department will be defined by the low point in the long run average total cost curve for the department. The long run average total cost function for each department will be the sum of the long run average specific cost function and the per unit average joint cost at the optimum plant size, which will be a constant. The long run average specific cost for each department will include the supply price for the raw product inputs as well as the specific operating costs for the department.

Figure 5A visualizes this situation for a three department joint purchasing plant. The output for all three departments is assumed to be in comparable units so as to be additive. The optimum plant size is at the output OQ which minimizes the long run average joint cost function at QG.

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[1]The long run joint costs will include such things as manager's salary, cost of office building, equipment and employees, costs of warehouses and transportation equipment, land rent, and so on.

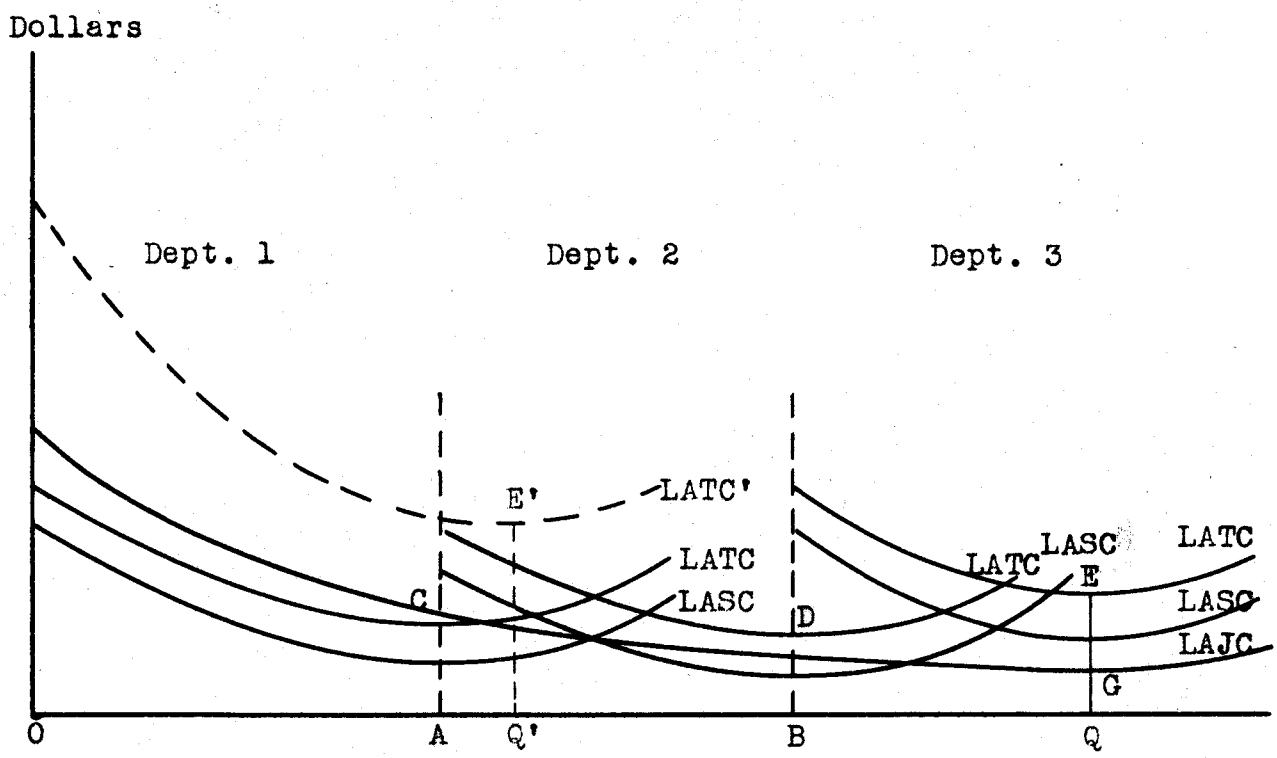

Figure 5A. Optimum size in a three department joint purchasing plant.

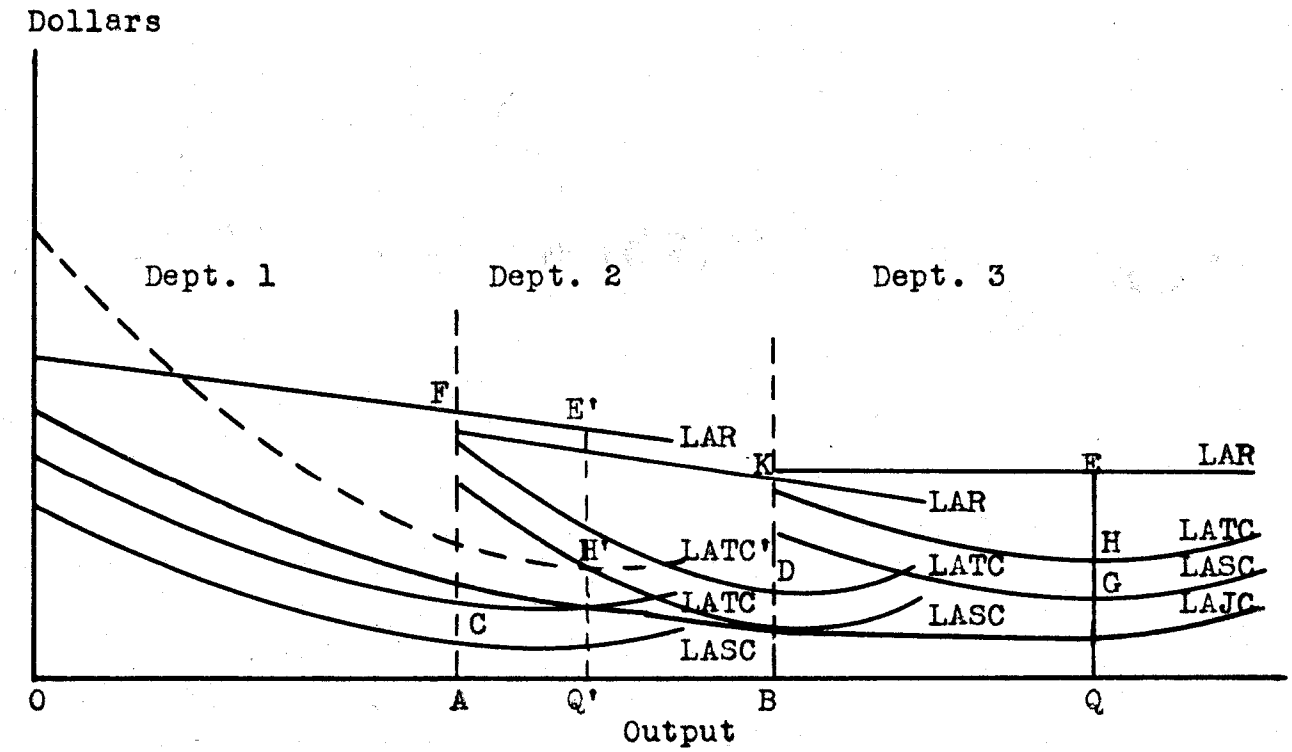

Figure 5B. Optimum size in a three department joint marketing plant.

The LATC curve for each department equals the LASC curve for that department plus QG. The optimum size for department 1 is at the output OA where the long run average total cost is minimized at AC. The optimum size for department 2 is at output AB where the long run average total cost is BD, and for department 3 at output BQ where the long run average total cost is QE. In this case if the joint purchasing plant consisted only of department 1, the optimum size would be OQ' at the output where the average total cost function (the sum of the long run average specific cost function and the long run average joint cost function) is at a minimum. Average total per unit cost to the firms participating in the department would then be Q'E' rather than AC as at present.

The participating entrepreneurs of a multiple department joint marketing plant will also achieve the optimum size in their plant when a sufficient number of departments, each of optimum size, has been added to minimize the long run average per unit joint cost in the plant. The optimum size in each department will be at that department output which maximizes the vertical distance between the long run average total cost curve and the long run average revenue curve in the department. The long run average total cost function for each department will be the sum of the long run average specific cost function and the per unit average joint cost at the optimum plant size, which will be a constant. The long run average specific cost for each department will

not include the supply price of the raw products furnished to the department by the participating firms, but only the specific operating costs for the department.

These conditions are illustrated in Figure 5B. The optimum plant size is again at the output OQ which minimizes the long run average joint cost function at QG. The optimum size for department 1 is at the output OA where the vertical distance between LATC and LAR, CF, is maximized. The optimum size for department 2 is at the output AB where the vertical distance DK is maximized, and for department 3 at output BQ where the vertical distance HE is maximized. If the joint marketing plant consisted only of department 1 under these conditions, the optimum size would be OQ' at the output where the vertical distance between the long run average revenue curve and the long run average total cost curve (the sum of the average specific cost function and the average joint cost function), H'E' is at a maximum. The total average net per unit revenue to the participating firms for products marketed through the department would then be only H'E' rather than CF as at present.

Where the type of production carried on by the participating firms warrants it, and when long run joint per unit costs decrease with volume in the joint plant, the participating firms all maximize their profits by adding departments, each at its optimum size, until a size is reached in the joint plant which minimizes the long run average joint per

unit cost. This optimum size, both for each department and for the joint plant as a whole, is achieved by securing the number of participating firms in the joint activity which will provide the volume necessary for the optimum.

IX. EQUILIBRIUM IN THE COOPERATING FIRMS

The problem confronted at this juncture is to define the static equilibrium position in the firm which participates in a common plant jointly operated as an integrated part of several firms. It involves the application of the generalized theory[1] of firm equilibrium which maximizes profits to the firm to the case where a part of the production activities of the firm include participation in the joint plant. For analytical purposes the determination of this equilibrium position is distinct from the determination of the optimum joint plant size which is discussed in the previous chapter. The two are interrelated, however, since the actual joint plant size at any given time is a function of both the number of participating firms and the size of each participating firm,[2] and the optimum position for each firm depends in part upon the size of the joint plant as it affects plant costs and revenues at the margin. The profits of each participating entrepreneur will be at their maximum only when optimum resource allocation in production has been achieved

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[1] Generalized in the sense that the theory considers the utilization of several resources to produce several products, considers a supply schedule for factors and a demand schedule for products facing the firm (which may be perfectly elastic but not necessarily so) and allows for discontinuities in the production function.

[2] Firm size for this purpose includes only those activities within the firm of which the jointly conducted activity is an integral part.

in each participating firm and when the number of firms necessary for optimum size in the joint plant participate in it.

Except where stated otherwise, it will be assumed in the present chapter that the optimum number of firms participate in the joint activity, so that, at the point of equilibrium output in each participating firm, the joint plant will be of optimum size. The problem as thus resolved consists of the determination of the equilibrium position for each cooperating firm. This problem has two aspects. One is the allocation of resources within the participating firm to achieve the best production combination, and the other is the determination of the optimum output for each firm. In both cases both the production activities conducted individually and those conducted jointly by each firm must be considered.

The determination of the allocation of resources between the joint plant and the individual production activities for each firm is simply the determination of the optimum resource allocation within the firm. Production carried on outside the joint plant and that carried on in it may be considered as two phases of the total production of a single output, since the output of the joint plant is an input of the individual plants of the participating firms, or vice versa.

The comparative productivity of resources in the joint plant and in other departments within the firm will determine

resource allocation between the joint plant and other activities in the firm, and in the extreme case whether or not it is economic to allocate any resources at all to the joint activity.

A. General Conditions of Firm Equilibrium

Following Carlson,[1] Lange,[2] Hicks,[3] Samuelson,[4] and others, the necessary, sufficient, and total conditions for static equilibrium within the firm utilizing more than one factor to produce more than one product may be specified under the profit maximization assumption. First when the supply function for all inputs and the demand function for all outputs to the firm are perfectly elastic, and the production function is given, Hicks[5] gives the following conditions for firm equilibrium:

1. Necessary conditions
   a. The technical rate of substitution between any two products produced by the firm must be equal to the price ratio between these two products.
   b. The marginal rate of substitution between any two factors must be equal

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[1] Carlson. op. cit., especially Chap. 3 and 5.

[2] Lange. Price Flexibility. . . . Chap. 7.

[3] Hicks, J. R. Value and Capital. 2nd ed. Clarendon Press. Oxford. 1946. Chap. 6.

[4] Samuelson. op. cit., Chap. 4.

[5] Hicks. op. cit., p. 86-88.

to the price ratio between these two factors.

c. The marginal rate of transformation between any factor and any product must be equal to the price ratio between the factor and the product.

2. Sufficient conditions
   a. The marginal rate of substitution between any two products, or two groups of products, must be increasing.
   b. The marginal rate of substitution between any two factors, or two groups of factors, must be decreasing.
   c. The marginal rate of transformation between any factor and any product or any group factors and any group of products, must be decreasing.

3. Total conditions
   a. It must not pay to discontinue production in the firm entirely, to discontinue the production of any product or groups of products, or to discontinue any production process in connection with any one product or group of products.
   b. It must not pay to add the production of any new product or groups of products, or to add any new production process in connection with any one product or group of products.
   c. It must not pay to use any input not now used or to discontinue any input now used.

These conditions for static equilibrium within the firm are based on the assumption that prices for both inputs and outputs are given to the firm. They must be generalized to allow for other than perfectly elastic supply curves for inputs and demand curves for outputs facing the firm. Marginal expenditure for factors of production must be substituted for factor prices, where the marginal expenditure for a factor is defined as the increment of the firm's total

revenue for output resulting from the sale of an additional unit of the product. The factor price and the marginal expenditure for the factor will be identical when the supply of the factor to the firm is perfectly elastic, and will be constant for all units of output. Otherwise the two will not be identical and marginal expenditure for the factor will not be constant over volume. Exactly the same is true insofar as product price and the marginal return for the product are concerned.[1]

Thus in the general case the necessary conditions for firm equilibrium, given the production functions, the supply functions for inputs and the demand function for outputs, are:

a. The technical rate of substitution between any two products produced by the firm must be equal to the ratio of the marginal returns between these two products.
b. The marginal rate of substitution between any two factors must be equal to the ratio of the marginal expenditures between these two factors.
c. The marginal rate of transformation between any factor and any product must be equal to the ratio of the marginal expenditure for the factor and the marginal return for the product.

In addition to these the same sufficient conditions and total conditions as in the previous case must be met.

Samuelson[2] has shown that discontinuities in the

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[1] If p is the price of the added unit of a factor and E is the elasticity of its supply, the marginal expenditure is $p(1 + 1/E)$. Similarly if p is the price of added unit of a product produced and e is the elasticity of its demand function, the marginal return is $p(1 - 1/e)$. Cf. Lange. op. cit., p. 38.

[2] Samuelson. op. cit., p. 70-76.

production function, from whatever cause, do not interfere with the determination of the equilibrium position in a particular firm. By setting up conditions of inequality, he has demonstrated that the necessary, sufficient and total conditions of equilibrium apply where the production function contains discontinuities as well as where it is continuous and with continuous partial derivatives. Discontinuities tend to make the equilibrium position unusually stable, but certainly not indeterminate.

It is unnecessary for the purpose at hand to review the external conditions for equilibrium in the firm, since they are beyond the control of the firm and do not enter into its objectives. The firm does not seek to equate average cost with average revenue so that profits are maximized at zero; if freedom of entry is postulated, it may eventually be forced into this position by other firms in the market. The external conditions need not be considered in order to define the conditions for profit maximization in any given firm, including the firm which participates in the cooperative association.

The cooperating firm will achieve optimum resource use when it has allocated its resources in such a way that the ratio of the marginal expenditure for each resource to the marginal physical productivity of the resource times the marginal return from the output produced is equal for all

resources used in the firm and for all alternative uses of these resources within the firm.[1] The firm will maximize its profits when, in addition to meeting these conditions, it has expanded total operations to the point where the marginal cost is equal to the marginal revenue for each product produced, the marginal revenue defined to include not only the revenue increase of the product, but also the change in revenue of the other products.[2]

B. Best Production Combination

The ratio of the marginal expenditure for each resource to the marginal physical productivity of the resource times the product of the marginal return from the output produced may be referred to, after Carlson,[3] as the cost-productivity ratio for the resource. This cost-productivity ratio must be equal for all inputs used and for all outputs produced in the firm in order that the best combination of outputs will be produced with the least cost combination of inputs. The firm participating in the joint plant must equate this cost-productivity ratio for all outputs produced by the firm, whether they are produced entirely outside the joint plant or partly outside the

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[1]Providing the sufficient and total conditions are also met.

[2]Carlson. op. cit., p. 99.

[3]Carlson. op. cit., p. 33.

partly within it. The cost-productivity ratio must be equal for all resources used by the firm in each of the alternative uses in the total production activity of the firm.

All three of the functions in this cost-productivity ratio may be affected by interrelationships between outputs or between inputs.[1] The marginal physical productivity of any factor in any use in the firm, within the joint plant or outside of it, will be affected by the technical interdependence of the different products produced in the firm. The marginal physical productivity of a given factor in a given use will be greater, unchanged, or smaller depending upon whether on balance the product is technically complementary, independent, or competing with the other products produced by the firm. This interdependence may change as volume of output changes. The effect of technical complementarity, independence, or competitiveness may be lessened, modified or reinforced, respectively, if the input price increases with the quantity of the input used.

The marginal return for the output produced will be greater, unchanged or less depending upon whether the product on balance is complementary, independent, or competing in demand with the other outputs produced in the firm. The

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[1] Cf. Carlson. op. cit., Chap. 5.

marginal expenditure for the factor will be greater, unchanged, or less depending upon whether the factor on balance is complementary, independent, or competing in supply with other inputs used in the firm. In these two cases again the interdependence may change as volume changes. In a given situation, these effects will be the stronger the greater is the slope of the demand curves for output and the supply curves for input facing the firm. With the definitions used for marginal expenditure and marginal return (p. 182-183), however, equating the cost-productivity ratios for all inputs in all uses defines the best production combination in the cooperating firm when these technical, demand and supply interdependencies are considered.

The proportional fraction of the joint plant operated as a part of a given participating firm will ordinarily not represent a distinct department or resource in the firm, but a part of one or more distinct departments, each producing a given output. The cost-productivity ratios for each resource will be equated between uses or departments, not between the joint plant and the firm activities outside the plant as such. The physical location and separation of the production activities of the firm has no necessary connection with the functional distinction between them; physical location also does not affect interrelationships between functionally related activities of the firm. Where the production of a single output is carried on by the firm in part outside the joint

plant and in part within it, there is only one cost-productivity ratio for each resource utilized in the production of this particular output. In comparison to other outputs of the firm, the firm expands this particular output to the point where the cost productivity ratio for each resource used in producing the output, including that part within as well as that part outside the joint plant, is equal to the cost-productivity ratio for all resources used to produce all other outputs in the firm.

An example may help clarify this point. Suppose a given participating firm is using inputs a, b, and c to produce outputs x, y, and z, and that x and y are produced entirely outside the joint plant while z is produced in part within the plant and in part outside of it. This firm will achieve the best production combination when it equates the cost-productivity ratio for a, b, and c in the production of each of x, y, and z and also for each of a, b, and c in the production of x, y, and z. The cost-productivity ratio for producing z will depend upon the marginal expenditure for a, b, and c, the marginal return for z, and the combined marginal physical productivity (within and outside the joint plant) of each of a, b, and c in the production of z. If the participating firm is a farm enterprise, the joint plant is a cooperative creamery, and z is butter, the firm will equate the cost-productivity ratio for all three inputs used

in the butterfat production on the farm and the butter production in the creamery, taken together, with the cost-productivity ratio of these inputs in producing x and y on the farm.

In other words the participating firm will consider both that part of the production process relative to a given output carried on within the joint plant and that carried on outside the plant in determining the relative amount of this output and the relative amounts of the other outputs of the firm to produce. The firm will not consider any separate process in the production of a given output alone but will consider the entire production process of the output as a unit. In order to maximize its profits the firm must also satisfy the total conditions (see p. 182). These, not the marginal conditions, insure that the joint activity represents optimum resource allocation as an integrated part of the total operations of the participating firm. If it is possible for the participating firm to increase its profits by discontinuing the process carried on in the joint plant or any part of it, or by discontinuing production of the output processed through joint plant, the firm is not in static equilibrium and should reallocate its resources accordingly. In all cases where the production operations of the participating firm with respect to a given product or products are carried out in part in the joint plant and in part in its

individual plant or plants, the joint plant operations cannot be considered separately from the related operations of the firm outside the plant, even for purposes of defining the best production combination in the firm.

In summary, then, the participating firm will achieve the best production combination when the cost-productivity ratio--the ratio of the marginal expenditure for an input to the product of the marginal physical productivity of the input times the marginal return for the output produced--is equal between all inputs in the production of all outputs in the firm. The sufficient conditions are decreasing marginal rate of transformation, increasing marginal rate of substitution between outputs, and decreasing marginal rate of substitution between inputs. The total conditions specify that it must not be possible to increase net revenue by utilizing any inputs or adding the production, or a process in the production, of any outputs which are not being utilized or conducted, or by discontinuing any that are. All these conditions must hold for the entire operations of the participating firm, including that part in the joint plant.

C. Optimum Firm Size

The optimum size of the firm participating in the joint plant, as for any firm, is defined by the output which equates the marginal cost with the marginal revenue for each

product produced[1]--the output which, assuming the best production combination, equates the marginal revenue productivity of each input in the production of each product with the marginal expenditure for that input.[2] This holds true in the long run when all inputs are considered variable and also in the short run when certain inputs are fixed. The only difference is that the relevant curves are long run in the first case and short run in the second.

These conditions hold as well for the participating firm as for the firm which takes part in no joint activity. The only special application that needs to be made is due to the fact that the participating firm has, jointly with other firms, vertically integrated the economic functions carried on in a common plant with the individual functions of the firm outside the plant. The two operations, taken together, determine the marginal revenue productivity of the resources used in the firm; the optimum firm size will therefore be defined considering the two operations jointly. The firm's entrepreneur is interested in maximizing nothing in either the joint plant or in the separate plant or plants of the firm independently as such, but rather in maximizing profits to his firm as a whole.

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[1]Provided the marginal cost curve intersects the marginal revenue curve from below.

[2]Marginal revenue productivity in this connection is defined as the product of marginal physical productivity and marginal return.

Analytically the application of the maximization conditions to the cooperating firm can best be done by first applying them to a single multi-plant vertically integrated firm and then proceeding to the cooperating firm. The vertically integrated multi-plant firm will be defined as a single profit maximizing entity operating a chain of two or more plants under common entrepreneurial control, with these plants operated in such a way that the output of the first is the raw product input of the second, the output of the second is the raw product input of the third, and so on. The production will be carried on successively through the various plants so that only the plant furthest from the consumer faces a supply curve for raw product inputs and only the one nearest the consumer faces a demand curve for output. Assuming the vertically integrated firm has achieved best production combination, its objective is to operate at the output which will maximize its profits.

Hirsch[1] has considered this case. He demonstrates the equilibrium output for such a vertically integrated firm under each of five restrictive assumptions. The output of each plant is measured in comparable units so that the relevant functions in each plant can be plotted on the same diagram. His five cases and the equilibrium output for the

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[1] Hirsch. op. cit., p. 97-144.

firm under each are as follows:

1. Costs are assumed to be zero for all outputs in all plants except the one furthest from the consumer. In this case the equilibrium output is defined by the point of equality between the marginal cost function in the plant furthest from the consumer and the marginal revenue curve in the plant nearest the consumer.

2. Only fixed costs are assumed in all plants except the one furthest from the consumer. Marginal costs in all plants except the first are thus again zero for all outputs and the firm again equates the marginal cost in the 1st plant with the marginal revenue in the nth plant.

3. Per unit costs at a fixed rate (K) are assumed for all outputs in all plants except the one furthest from the consumer. The firm equates the marginal cost in the 1st plant plus K with the marginal revenue in the nth plant.

4. The same situation is postulated as in the third case, except a fixed payment is made to an outside firm for services (e.g., transportation). This fixed payment does not enter into marginal cost so the firm again equates the marginal cost in the 1st plant plus K with the marginal revenue in the nth plant.

5. Again the same situation is postulated as in the third case, except a fixed per unit payment (L) is made to an outside firm for services. The firm achieves optimum output by equating the marginal cost in the first plant plus

K plus L with the marginal revenue in the nth plant.

After demonstrating the equilibrium position of the vertically integrated firm under these restrictive assumptions, Hirsch does not make the transition to the general case. It follows logically, however, from his analysis. Such a firm will, assuming it has achieved the best production combination, maximize its profits by operating at the volume which equates the sum of the marginal cost curves of all plants with the only marginal revenue curve it has, namely that faced in the plant nearest the consumer. This is the general case which embraces all five of the postulated special cases of Hirsch. Whether the marginal cost in some of the plants is a constant, whether it is zero in some of them, or whether it is a function in all of them, equating the sum of the marginal costs for all plants with the marginal revenue in the final plant will define the optimum output for the vertically integrated firm. The integrated multi-plant firm does not try to maximize profits in each plant by using some sort of accounting "price" for the output of each. It is not concerned with the profitability of any one plant singly, once the best production combination has been determined, but only with maximizing the profits of all plants taken as a unit.

The equilibrium output for a vertically integrated four-plant firm is illustrated in Figure 6. The output of all

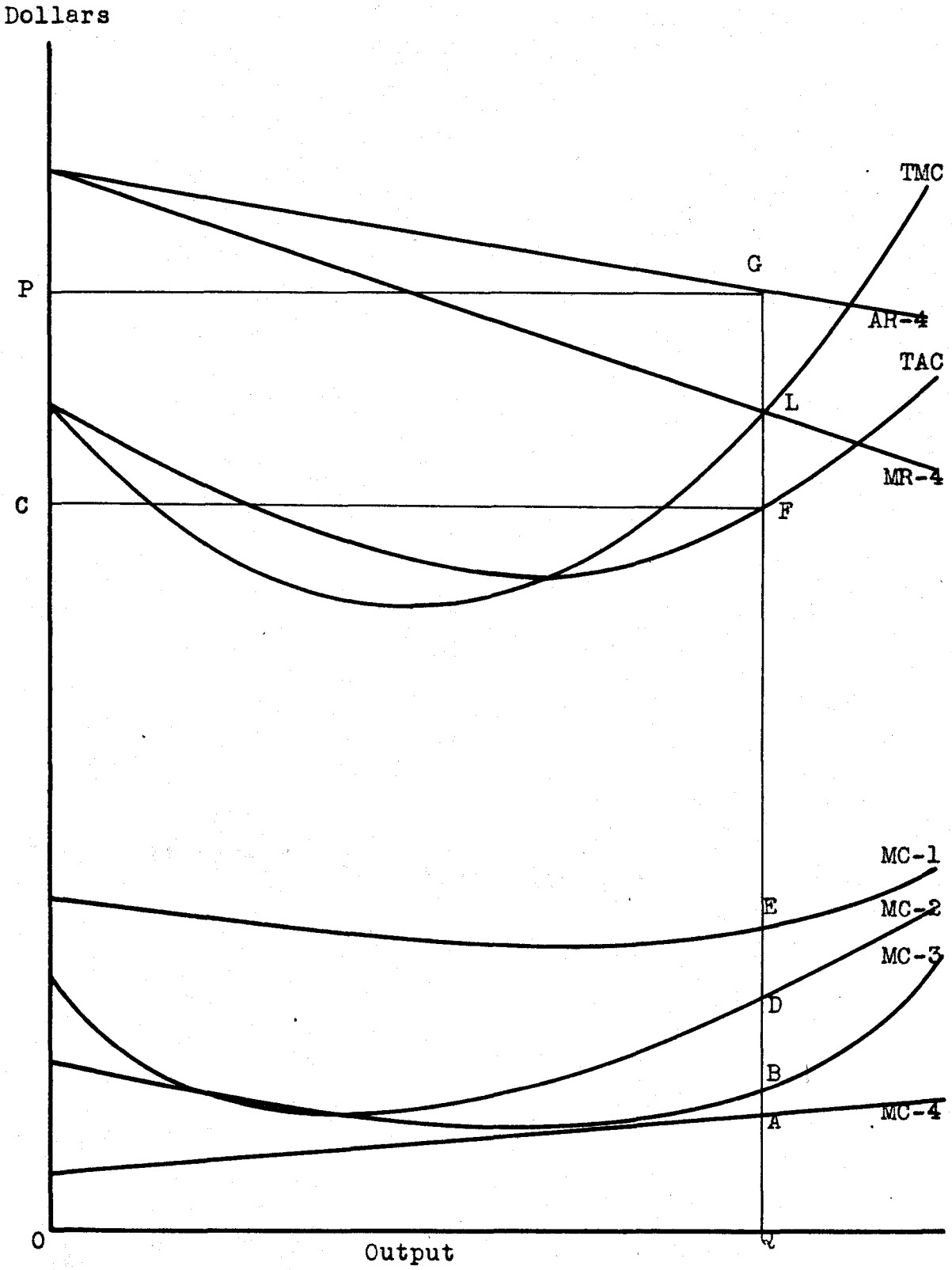

Figure 6. Vertically integrated firm. Long run equilibrium.

four plants is assumed to be measurable in comparable units so that the output for each is measured on the same scale along the X axis. The marginal cost in each plant is given, with MC-1 representing that for the plant furthest from the consumer, MC-2 the marginal cost for the second plant, MC-3 that for the third and MC-4 that for the plant nearest the consumer. AR-4 and MR-4 represent the average revenue and marginal revenue, respectively, faced in the final plant. TMC is the total marginal cost function which is the sum of the four functions MC-1, MC-2, MC-3 and MC-4; QL is equal to QA plus QB plus QD plus QE. The optimum firm output, and output in each plant, is OQ where TMC intersects MR-4. At this output the integrated firm maximizes its profits, the area CFGP. The firm sells OQ units of output from the final plant for the price OP per unit. The total per unit costs to the firm (including those in all four plants) is OC. The input costs in the second, third, and fourth plants are net of costs for raw products because they are furnished by the previous plant in each case.

This figure represents the long run analysis only. In the short run TAC would not be total average costs, but instead total average variable costs; total average costs would be this curve plus the average fixed costs for the four plants. Of course in the short run the marginal cost for each plant would have a different shape and would be nearer the X axis, as would the total marginal cost curve and the

total average variable cost curve. However the short run equilibrium will be determined in the same manner as the long run equilibrium in the integrated multi-plant firm, i.e., by equating the sum of the marginal cost functions for all plants with the marginal revenue function in the plant nearest the consumer.

In order to achieve the best production combination, a vertically integrated firm such as the one illustrated in Figure 6 establishes and operates only plants which represent optimum resource use in the firm, as determined by its total operations. Such a firm determines the output for all plants on the basis of its total operations. What happens if the economies of size in one of the plants make it uneconomic to operate the plant at this output? Such a case would be visualized in Figure 6, for example, if MC-1 were located sufficiently above the X axis and downward sloping over a volume range beyond that shown on this diagram. The vertically integrated firm would then choose the most economic of three alternatives. It would either: (1) confine its operations to plants 2, 3 and 4, purchasing the output of plant 1 in the market; (2) operate plant 1 at an economic volume, marketing the difference between OQ and the optimum output for this plant; or (3) operate plant 1 jointly with another similarly vertically integrated firm of sufficient size to give a combined volume in plant 1 great enough to make its operation economic to both integrated firms.

Under the first alternative the marginal cost in plant 2 would be equal to the present MC-2 plus the marginal expenditure function for the input now supplied to it by plant 1. Under the second alternative the firm would face a marginal revenue curve in plant 1 which would have to be considered in its total operations in order to achieve equilibrium. Under the third alternative the relevant portion of the marginal cost curve in plant 1 will not be that over the OQ range, but that segment from the optimum output of the second integrated firm on over the output range of the first integrated firm. The firm will select the most economic of these three alternatives, considering the effect of each on its total operation.

The equilibrium position under the third alternative is illustrated in Figure 7. The two firms, I and II, operate plant 1 jointly. Each operates a second plant entirely independently of the other. The output of plant 1 is used entirely as an input for the plants operated independently by each of the two firms. MC-1 is the marginal cost function in the joint plant. MC-2 for firm I is the marginal cost in the second plant operated by this firm, and MC-2 for firm II is the marginal cost in its second plant. The output for the joint plant and the second plant of each firm is assumed to be in comparable units and measured on the same output scale. Firm II produces at the output AB where the sum of the

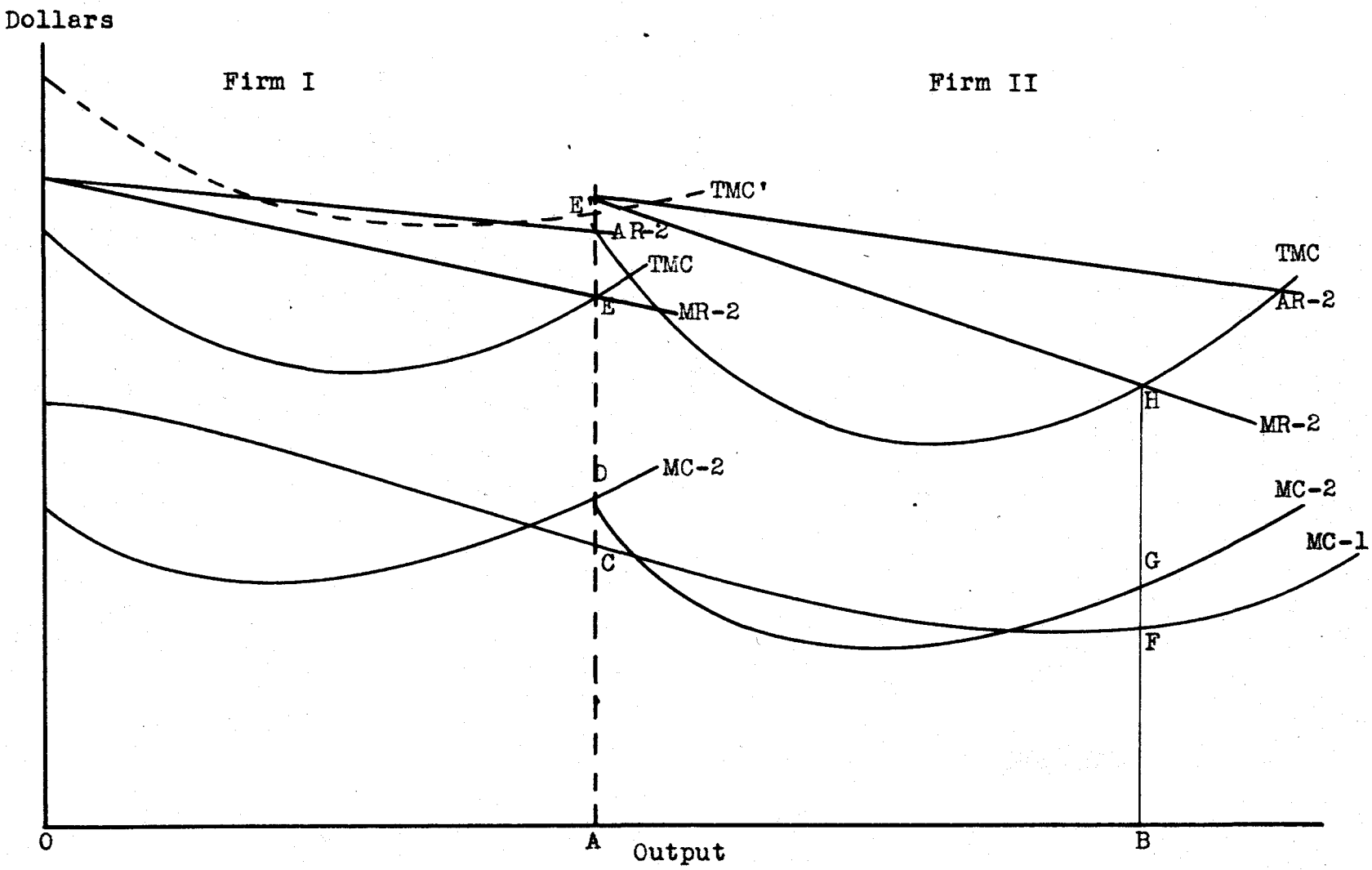

Figure 7. Participating firm equilibrium. Two firm plant.

marginal cost in the joint plant and the marginal cost in its second plant equals the marginal revenue in the second plant. The relevant segment of the MC-1 curve to firm II is CF, beginning with the equilibrium output of firm I. The TMC curve is the sum of the MC-2 curve for firm II and the segment of the MC-1 curve to the right of C. BF plus BG is equal to BH. The equilibrium output for firm II, assuming the best production combination, is at AB as defined by the intersection of TMC and MR-2, at H.

Firm I produces at the output OA where the sum of the marginal cost in the joint plant and the marginal cost in its second plant equals the marginal revenue in the second plant. The relevant segment of the MC-1 curve is that starting at the equilibrium output of firm II, rather than at zero. In Figure 7, since AB is equal to OA, the relevant segment of this curve to firm I is also CF. The TMC curve for firm I is the sum of its MC-2 curve and the MC-1 curve to the right of C. AD plus BF is equal to AE. The equilibrium output for firm I is defined by the intersection of TMC with MR-2 at E as OA units. If firm I operated plant 1 alone, the total marginal cost to the firm would be TMC' rather than TMC, since the relevant segment of MC-1 would be that starting from zero, and AC plus AD is equal to AE'. In such case the firm would not be able to cover costs, and would not set up plant 1 in this manner but move to the best of the three alternatives mentioned above.

Notice that the size of the joint plant, aside from the agreement by two firms to set it up and operate it jointly, is not determined by a decision made by the two firms jointly. It is determined by the sum of the optimum volume in each firm, and the optimum volume in each firm is determined independently, taking into consideration the entire operations of the firm in each case. In Figure 7, the joint plant output, AB, is given when the respective output for the two participating firms, OA and AB, is determined. However the precise equilibrium output in firm I cannot be determined unless the equilibrium output of firm II is taken as given, because without this information the exact segment of the marginal cost in the joint plant which is relevant is unknown. The same is true regarding firm II; the equilibrium output of firm I must be taken as given in order to define the optimum output in firm II when considered alone. The formal solution of the optimum output in each participating firm, and in the joint plant, given the number of participating firms, must be done simultaneously. Actually, even in the static sense considered here, since the marginal cost incurred by each firm in the joint plant depends not only on the output of that firm but also on the output of the other participating firm, the two firms may approach their individual equilibriums by trial and error. How quickly and accurately the two entrepreneurs will approach optimum volume in their respective firms depends on the accuracy of their

respective conjecture of the other's optimum volume and adjustment to the optimum.

The profit maximization conditions just described for the two vertically integrated firms operating a joint plant are quite easily generalized for n participating firms in a cooperative association. The n participating firms are vertically integrated by the definition used here (see page 192).[1] They each operate one or more separate plants and together operate at least one common plant jointly as a part of each vertically integrated participating firm. If it is assumed that each of the n participating firms produces only one product, and that each is producing at the best production combination, each will maximize its profits at the output which equates the marginal revenue in the final plant with the sum of the marginal cost functions for all plants. The relevant segment of the joint plant marginal cost function to each firm for this purpose is that part to the right of the sum of the optimum outputs for all other participating firms.

If the output of the joint plant is a raw product input in the individual plants of the participating firms, each of

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[1] Where the output of the joint plant is not the raw product input of the individual plants of the participating firms, but instead a specific resource fnput, the firms are not actually vertically integrated under this definition and the analysis is modified. See pages 209-211 below.

the n participating firms will face the marginal revenue curve in their individual plants, and each may face a different marginal revenue function. Such is the case in the example in Figure 7. On the other hand, if the output of the individual plants is a raw product input for the joint plant, the n participating firms will face a common marginal revenue curve in the joint plant. In this case the only relevant segment of the marginal revenue curve to each participating entrepreneur is that part starting with the sum of optimum outputs for all other participating firms and embracing the volume added by the given firm. Each firm must assume that all other participating firms are producing at equilibrium output in order to determine not only the exact total marginal cost function but also the exact marginal revenue function. Formally the solution is obtained simultaneously with the n equations (total marginal cost function equal to the marginal revenue function) for the n participating firms and the (n + 1)th equation (output in the joint plant equal to the sum of the outputs in the n firms) for the joint plant. The n + 1 unknowns are the equilibrium output for each participating firm and the equilibrium output in the joint plant.

These conditions are portrayed in Figure 8 for five firms, each operating one plant independently, which operate one plant jointly. The diagram represents the case where the joint plant is the one from which the output of the

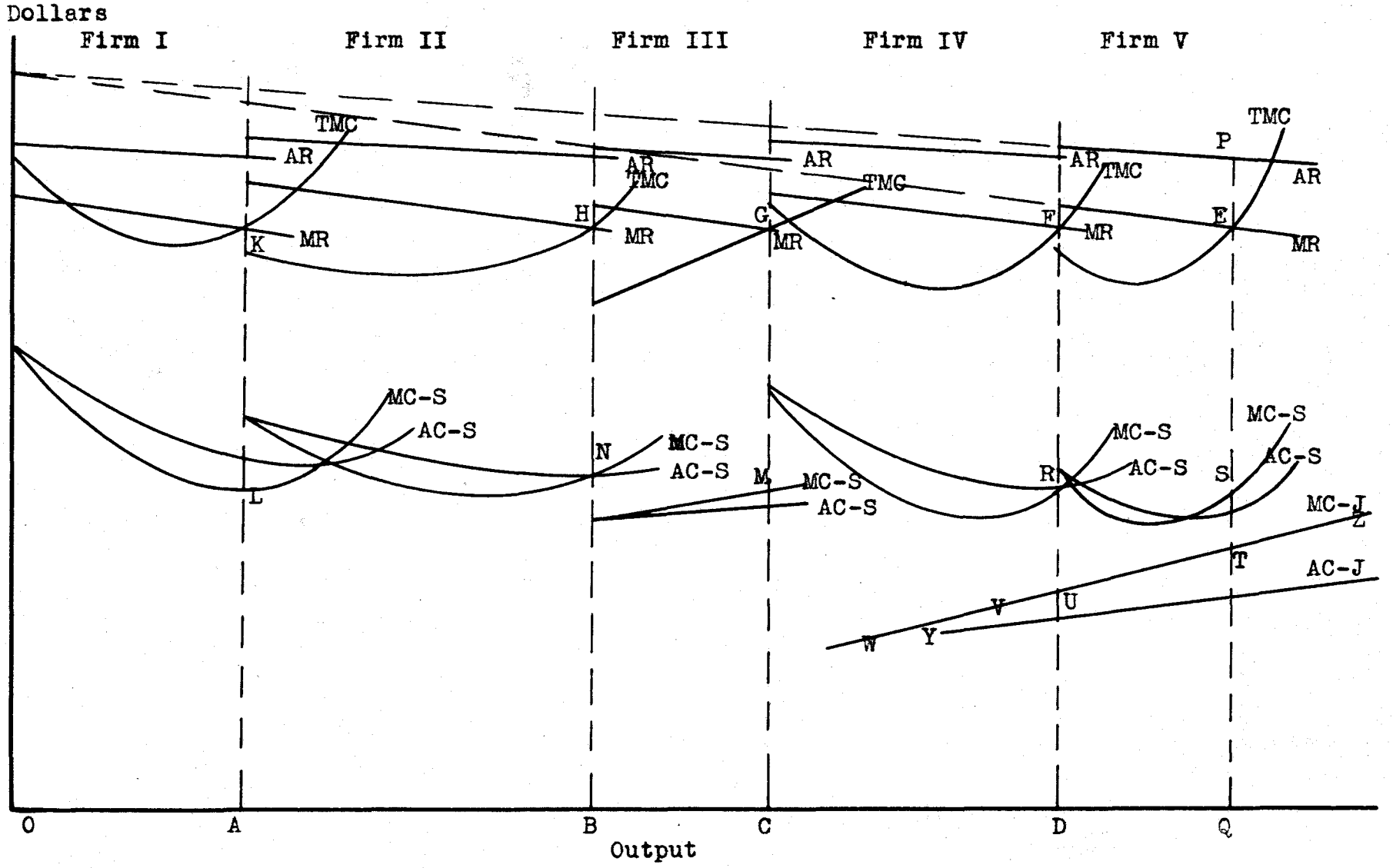

Figure 8. Participating firm equilibrium. Five firm plant.

participating firms is marketed as well as the case where the joint plant output is a raw product input for the individual plants of the participating firms. AC-S and MC-S are the average cost and marginal cost functions, respectively, in the individual plants of each of the five participating firms. AC-J and MC-J are the average cost function and the marginal cost function respectively in the joint plant. AR and MR are the average revenue and marginal revenue facing each of the five firms. The TMC curve is the total marginal cost function in each of the five firms.

The equilibrium outputs are OA for firm I, AB for firm II, BC for firm III, CD for firm IV, and DQ for firm V, as defined by the intersection of TMC and MR in each case. The TMC curve is the sum of the marginal cost in the individual plant and the marginal cost in the joint plant for each firm. The relevant section of MC-J to firm I is VZ since V represents the joint plant output equal to the sum of AB, BC, CD and DQ. To firm II the relevant section of MC-J is WZ because W represents the plant output equal to the sum of OA, BC, CD and DQ. Similarly the relevant section of the MC-J function to firm III is UZ, to firm IV is YZ, and to firm V is UZ. AK is equal to AL plus QT; and QE is equal to QS plus QT.

If the output of the joint plant is input to the separate plants of the participating firms, no peculiar relationship between the revenue functions of the five firms results from their joint operation of a common plant, because each firm

markets its output individually. If the output of the separate plants of the participating firms is input in their joint plant, however, they face the same demand and marginal revenue function jointly. When the demand curve is negatively sloped, the price for the product to each firm is not determined alone by the quantity produced by it, but by the marginal unit of the product marketed from the joint plant. The relevant segment of the marginal revenue function to each of the five firms in Figure 8 is at the same output range in the joint plant as that of the section of the MC-J function which is relevant to each of the firms, respectively. The vertical distances AK, BH, CG and DF are all equal to the vertical distance QE, and they must be in order for all five firms to be in equilibrium because the price of the entire output of the joint plant (OQ units) is QP. The per unit profit for each of the firms will not necessarily be the same in equilibrium, however, because the total average cost function for each includes the average costs in their separate plants, which may vary from one firm to another, as well as the average costs in their common plant.

The equilibrium position in all participating firms does not define the optimum size in the joint plant, since the number of participating firms is taken as given. The determination of optimum joint plant size is a separate problem and is discussed in the previous chapter. In contrast to the case in Figure 7, the joint plant in Figure 8 is not of

optimum size, either for joint purchasing plant or a joint marketing plant. The optimum plant size is somewhere to the left of output OD, with approximately three participating firms instead of the five. If the complete average cost curve for the joint plant were given in Figure 8, the necessary number of participating firms for maximum operating efficiency in the joint plant could be determined accurately.

The diagram in Figure 8 assumes all costs to the participating firms are variable, and therefore represents long run equilibrium. The short run equilibrium for each firm is determined in exactly the same way, except that all marginal cost functions will include only the variable cost items, and the short run demand and marginal revenue functions will apply rather than those for the long run. The short run output in the joint plant will be given by the determination of the short run output in the several participating firms. The same conditions that are necessary for long run equilibrium are also necessary for all participating firms to be in short run equilibrium. These conditions provide that each firm be at the best production combination considering its entire operation, and that total marginal cost equals marginal revenue for each firm, considering the relevant segment of the joint plant marginal cost, and in the joint marketing plant also the relevant segment of the marginal revenue to the firm. Both in the long run and the short run it is not necessary under imperfect competition that the

marginal revenue productivity for each resource be equal between participating firms, however, since the cost functions (and with joint purchasing plants the revenue functions) of their individual plants may differ. Nothing distinctive to this type of structure in addition to the conditions just developed is needed in order to generalize the equilibrium conditions for firms producing a single output through two or more integrated plants, one of which is operated jointly with other firms, to such vertically integrated firms producing more than one output.

The usual equilibrium theory for the firm producing joint products with joint resources is adequate. The firm producing several products, one or more of which is produced through two or more vertically integrated plants, some of which are operated jointly with other firms, will maximize its profits when it produces at the best production combination and expands the production of each product to the output which equates the marginal cost and marginal revenue for that product. The marginal revenue for each product includes not only the revenue increase of the added increment of the product itself, but also the associated changes in the revenue from the other products. The sufficient conditions are met if the marginal cost function is increasing more rapidly than the marginal revenue function for each product. A corollary of these conditions is that the marginal revenue productivity of each input in each alternative use in the

firm must be equal to the marginal expenditure for the input.

The relevant marginal cost to the firm for each of the products produced through vertically integrated plants is the sum of the marginal cost functions for all the integrated plants, including those operated jointly with other firms, and the relevant marginal revenue in such case is the one faced by the firm in the plant from which the product is marketed. This does not apply to those products produced in and marketed directly from a single plant, since the marginal cost and marginal revenue for these products are entirely determined in the plant where they are produced.

The equilibrium position for firms participating in a joint plant is thus defined when the firms are vertically integrated, as set forth in the definition on page 192. Where the joint plant is operated to obtain specific capital resources to be used in the production activities in the individual plants of the participating firms, the firms operating the joint plant are not included in this definition. Where the firms purchase capital resources, such as farm machinery, fertilizer, protein supplement, or obtain capital through their joint plant for use in their individual plants, as distinguished from procuring raw products, such as wholesale groceries, hardware or drugs, feeder steers, etc., jointly, the output of the joint plant and the individual plants of the participating firms cannot be measured in comparable units. The two do not represent two stages of the vertically

integrated production of a single product. The joint plant in this case has been set up by the participating entrepreneurs to economically procure resources needed in the production carried on in their individual plants.

The firms operating a joint plant for this purpose each determine the relative size of their operations in the joint plant by achieving the best production combination in the entire operations of the firm. Each will allocate resources to the joint purchasing plant to the point where the marginal cost in the joint plant is equal to the marginal revenue productivity of the resource procured through the joint plant in its individual plant or plants. The best production combination in each participating firm will be defined by the equating of the cost-productivity ratio of every resource, including those procured through the joint plant, with that of all other resources used by the firm in the production of all outputs of the firm. The equilibrium size of each of the participating firms will be defined at the output of each product which equates the marginal cost and marginal revenue of the product. This determination, except as affected by the marginal expenditure of the resources procured through the joint plant, will be made within the individual plants of the participating firms.

The optimum volume of participation by each firm in the joint plant will be defined by the intersection of the marginal cost function for the entire plant with the marginal

revenue productivity function of the plant output in the individual plants of each of the participating firms. Again the relevant segment of the joint plant marginal cost function to each participating firm is that segment to the right of (at outputs greater than) the sum of the equilibrium plant output for all other participating firms. This assumes the number of participating firms is given; it is distinct from the problem of optimum size in the joint plant. If there are differences in the nature and location of the marginal revenue productivity function of the joint plant output in the individual plants of the participating firms, the optimum volume of participation in the joint plant will vary between firms. The marginal revenue productivity of the last unit procured of the joint plant output by each firm must be equal to the marginal revenue productivity of the last unit procured by all other participating firms, however, in order for all firms to be at the least cost combination simultaneously (the vertical distance from the X axis to the point of intersection of the joint plant marginal cost and the marginal revenue productivity of the joint plant output must be the same for all firms). This is true because the marginal revenue productivity function for each firm is equated to a common marginal cost function in the joint plant.

X The vertically integrated firm operating more than one plant so that the output of one is the raw product input of another, and operating one or more of these plants jointly

with other firms, expands the output of each product to the point where the marginal cost of this output equals the marginal revenue from the product.[1] For products produced through two or more plants the firm equates the sum of the marginal cost functions in all plants with the marginal revenue in the plant from which the product is marketed. In the plant or plants operated jointly with other firms, the segment of the marginal cost function in the joint plant that is relevant to the firm is that part at outputs beginning with the sum of the volume of all other participating firms and extending upward. This is also true for the marginal revenue function if the product is marketed from the joint plant. Even though the participating firms are all operating at optimum volume, the joint plant may not be of optimum size. Joint plant size is optimum, as was pointed out in the previous chapter, at the output where the joint plant makes the greatest per unit net contribution to the income of each participating firm, and is varied over the long run by varying the number of participating firms. The participating entrepreneurs allocate resources to and take part in the joint plant when they maximize their profits by doing so. In determining the optimum allocation of resources to the joint plant for each of the participating firms, the operations of their individual plants and the operations of

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[1] Which is defined to include the change in revenue of other products.

the joint plant must be considered as an integrated production activity. The firms participating in cooperative associations are all vertically integrated under the above definition except where the joint activity is a resource purchasing plant. In this latter case, each participating firm expands its activity in the joint plant to the point where the marginal cost for the entire joint plant is equal to the marginal revenue productivity of this resource procured through the joint plant in the individual plants of each of the participating firms. In both cases the participating firms must meet the necessary conditions for best production combination and optimum output, and also the sufficient and total conditions, if they are to be in static equilibrium.

X. DYNAMIC CONSIDERATIONS

The conditions for equilibrium in the firm participating in a joint plant, and those for the optimum joint plant size, which have been developed in the two previous chapters, are based on static assumptions. These static conditions include timeless production, instantaneous adjustment, perfect knowledge and certainty. The supply and demand functions facing the firm are given rather than anticipated. It is necessary therefore to indicate the application of these static equilibrium conditions in the participating firm, and the necessary modificiations in them, when production takes place over time and in an uncertain environment. The intention here is not to attempt to devise a complete and satisfactory dynamic system either for each participating firm or for the several firms as a participating group in a common joint plant. It is rather to point out adaptations necessary in order to make the static equilibrium conditions reasonably applicable in more dynamic circumstances.

For the present purpose, each participating firm is assumed to be in equilibrium when the entrepreneur has planned production so as to obtain the highest possible position on his indifference map toward the capitalized value of the anticipated profit stream and the anticipated stability of this profit stream over time. The first of these two considerations is discussed in the first two sections following,

and the second is discussed in the third section. The two are brought together in the final section of this chapter. It is assumed throughout that the entrepreneur prefers a constant profit income distribution through time rather than some other time income distribution. By assumption, variations in his consumption demand for income over time are met by changing the percentage of owned equity in the firm and therefore do not affect the production plan.

A. Production Through Time

Production through time cannot be rigorously considered unless the economic variables in different points in time are functionally related. This can be done either with poly-period analysis, or by continuous flow or rate analysis.[1] The writings dealing with the dynamic theory of the firm have primarily used the first of these two methods. This is generally satisfactory since, if the periods used are short enough, changes within the period can be neglected and flows through time are approximated. With this approach the same input or output in different periods is treated as a separate input or output in each period.[2] By introducing the inter-temporal technical and price relationships between variables

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[1] Cf. Samuelson, Paul A. Dynamic Process Analysis. In Ellis, Howard S. A Survey of Contemporary Economics. p. 352-387. The Blakiston Co. Philadelphia. 1948. p. 354.

[2] Cf. Hicks. op. cit., p. 191-201.

in different periods of time as well as those within each period, the static equilibrium conditions within the firm for best production combination and optimum output may be applied to production over time.

To do this it is necessary to redefine marginal expenditure, marginal physical productivity and marginal return to include also the intertemporal relationships between and among inputs and outputs. Anticipated supply and demand price schedules facing the firm must be substituted for given ones,[1] and all anticipated future values of inputs and outputs must be properly discounted.[2] Following Carlson[3] the marginal expenditure for any input is defined as the increment of the firm's discounted total cost stream resulting from the purchase of an additional unit of the input. The marginal physical productivity of any input is the net increase in all outputs, properly discounted in physical terms, resulting from an additional unit of the input. The marginal return for any output is now the increment of the firm's discounted total revenue stream resulting from the sale of the added amount of this output plus the sale of the

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[1] Anticipations are taken as the most probable schedule, adjusted for uncertainty premiums and discounts. This is discussed further in the section dealing with anticipations below.

[2] At an assumed constant anticipated interest rate in each period. The effects of changes in the anticipated interest rate are discussed below also.

[3] Carlson. op. cit., p. 111-112.

net change in amount of other outputs. By so defining these concepts, provision is made for technical, supply and demand complementarity, independence, or competitiveness, as the case may be, between inputs and between outputs of different time periods as well as within each time period.

Since the objective of the participating firm now under consideration is the maximization of the capitalized value of the anticipated profit stream, the conditions necessary for static equilibrium hold for each time period under dynamic assumptions, subject to the above definitions and to capitalized anticipated variables rather than given ones. Each firm will produce the best combination of outputs at the least cost combination when the ratio of the marginal expenditure for each input to the marginal physical productivity of the resource times the marginal return for the output is equal for all inputs in the firm in all alternative uses in the firm.[1] Each firm will maximize its profit stream when, in addition to meeting these conditions, it has expanded total operations in each period to the point where the marginal cost is equal to marginal revenue for each product produced. The relevant marginal revenue function includes not only increases of the product but also the

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[1]Considering the same input or output in two different periods as two separate inputs or outputs.

changes in other products. This means that the marginal revenue productivity of each input in the production of each output is equated with the marginal expenditure for that input (both functions of course anticipated and discounted). In addition to these necessary conditions for equilibrium in the firm, total and sufficient, or stability, conditions must also be imposed, as under static assumptions. These conditions must provide not only that the equilibrium position is a maximum rather than a minimum, and that efficiency cannot be improved by adding or dropping any production process or input utilized, but also that any time the firm is thrown out of equilibrium, adjustments to again meet the equilibrium conditions will cause conversion to equilibrium.[1]

These conditions apply to the firm in general, and consequently have no peculiar bearing on the vertically integrated firm jointly operating one or more plants with other firms. They are applicable to such firms, however, in the same manner as developed under static assumptions in the previous chapter. In order to obtain the best production combination, each participating firm equates the cost-productivity ratio for all inputs in the production of all outputs of the firm, including that fraction of the firm in

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[1] The possible types of stability (and instability) for dynamic systems and the conditions for each are indeed complex. Probably the best reference available is Samuelson.

the joint plant. The Firm equates the sum of the marginal cost functions in all plants consecutively taking part in the production of a given product with the marginal revenue for the product. Outputs of the same product in periods other than the one considered are simply taken as separate products. The same goes for inputs. Interrelationships between these intertemporal outputs and inputs are included in the more inclusive definition of the functions involved in the cost-productivity ratio. Marginal expenditures and marginal returns under dynamic conditions, in addition to the broader definition, actually are discounted anticipated marginal expenditures and discounted anticipated marginal returns. With these modifications the static conditions for equilibrium developed in the previous chapter for the vertically integrated firm participating in a joint plant hold when production over time is considered. The same is true for the firm participating in a joint plant for the procurement of resources. With the above modifications in definitions, such a firm determines its optimum participation in the joint resource purchasing plant by equating the marginal value productivity of the resource so procured with the marginal cost in the joint plant. The relevant segment of the joint plant marginal cost function to each participating firm in both cases, as under static conditions, is that

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Foundations. . . . Part II. See especially p. 261-269, 302-307, 333-335.

segment starting at the output represented by the sum of equilibrium participation of all other firms rather than at zero.

B. Anticipations

In a dynamic setting expected price functions for inputs and outputs to the participating firm must be substituted for actual ones. The static conditions for equilibrium in the firm may be generalized to dynamic circumstances, as has just been done, provided these expectations are assumed to be single-valued, or that they can be reduced to single-valued expectations through the use of uncertainty premiums and discounts. The use of uncertainty premiums and discounts takes into consideration the degree of uncertainty of the expectation, i.e., the dispersion of expected price functions, as well as the most probable one. An increase in the dispersion of the expected price functions, even though the modal price function is unchanged, would make the expectation less favorable to the entrepreneur, and have the same effect as a reduction in the expected demand function for a product or an increase in the expected supply function for an input of the firm. Thus a change in the dispersion in the expected price functions is accounted for by considering the most probable price function plus or minus an allowance for the uncertainty of the expectation.

It is not possible to reduce the anticipations regarding the price functions to a single valued expectation if the entire probability distribution of the anticipations is considered. Furthermore each entrepreneur is guided not only by his opinion of the degree of uncertainty, but also by his ability and willingness to bear uncertainty. This problem has been approached in various ways by different authors. Tintner, for example, introduces an "uncertainty preference functional"[1] while Shackle replaces the anticipated probability distribution with a "surprise function",[2] to cite only two. It seems most useful, in the non-rigorous approach made here, to treat the expectations regarding the price functions facing the participating firm as reducible to single values so that the equilibrium conditions pointed out in the previous section hold for determination of the maximum discounted stream of anticipated profits. The nature of the uncertainty of expectations then comes in under the coordinate objective, the minimization of the variability in the profit stream, which is discussed in the last two sections of the present chapter.

As Hicks points out, expectations as to future prices and price-quantity relationships are guided by psychological

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[1]Tintner, Gerhard. The Theory of Production under Non-static Conditions. Journal of Political Economy. 50:645-667. 1942.

[2]Shackle, G. L. S. Expectations in Economics. Cambridge University Press. New York. 1949.

as well as economic factors.[1] Examples of the first are political news, weather, and the general health and state of mind of the entrepreneur. Economic factors include news regarding specific factors affecting the markets and general economic outlook and attitudes toward the future behavior of current trends in price-quality relationships. Hicks[2] and Lange[3] refer to the effect of current trends on expectations as the elasticity of expectations.[4] This elasticity will be zero when current changes are considered entirely temporary and to have no bearing on future expectations, and will be unity when current changes bring about a change in expectations in the same direction and in the same proportion. When expectations are inelastic (elasticity of expectation is less than unity) a fall (rise) in the current price-quality relationship will cause intertemporal substitution toward (against) current planned purchases and toward (against) future planned sales, assuming the interest rate constant. When expectations are elastic a fall (or rise) in the current price-quantity relationships will have the reverse effect.

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[1]Hicks. op. cit., p. 204-212.

[2]Ibid.

[3]Lange. Price Flexibility. . . . p. 20-28.

[4]Elasticity of expectations is defined as the ratio of the proportional increment of the expectation for the future to the proportional increment of the present change.

When the elasticity of expectation is unity a change in current price-quantity relationships will bring about no intertemporal substitution within the firm.

In addition to expectations of the supply functions of inputs and demand functions for output, the participating entrepreneur is concerned with his anticipations regarding technological innovations, the uncertain elements affecting the operation of his firm, and the attitude and behavior of other entrepreneurs participating in the joint plant.[1] As with the price-quantity relationships, these factors are not given for the firm in the dynamic world, but must be anticipated by the entrepreneur. They also must be reduced to single-valued expectations in any time period through the use of uncertainty premiums and discounts in order for the equilibrium conditions discussed in the previous section to be applied accurately. The effect of elastic and inelastic expectations is the same in the case of these anticipations as with anticipations regarding the price-quantity relationships affecting the firm.

The expected rate of interest has an additional role to the participating entrepreneur in planning production since the interest rate determines the relative importance of variables in the near future and those in the more distant

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[1] See p. 86-87 above.

future by specifying the discount rate. If the elasticity of the interest rate expectation is unity, a fall in the interest rate will cause intertemporal substitution against the most current outputs and in favor of the most current inputs. A rise in the interest rate will have the opposite effect.[1] With elastic interest rate expectations the effect will be in the same direction and somewhat more pronounced, while with inelastic interest rate expectations the effect will also be in the same direction, but somewhat less noticeable. Interest rate changes within the normal range will have a very limited effect on the discounted values of inputs and outputs in the near future. Such changes are of minor consequence, unless the entrepreneur, because of the technical production he is engaged in or the absence of extreme uncertainty in this production, or both, plans the activities for the firm for a relative long period. Discounted variables in the far distant future are very sensitive to expectations of interest rate changes.

The firm which participates in a common plant jointly with other firms is in dynamic equilibrium when the necessary conditions are applied to the <u>discounted value</u> of the <u>anticipated</u> variables, the same as is true for any firm. Because of the resulting structure, however, something must be said about the distinctive anticipations and application of anticipations in the participating firm. In the first place all vertically

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[1] Cf. Hicks. op. cit., p. 213-226.

firms, including those which operate one or more of their plants jointly, face an output market only in their final plant and a raw product input market only in their first plant. As was pointed out in the previous chapter, these firms do not--they cannot--equate the marginal cost and the marginal revenue in each plant.[1] Instead they equate the sum of the marginal cost functions in all plants with the marginal revenue function in the final plant. Therefore the entrepreneur of the vertically integrated firm is concerned only with the anticipated price-quantity relationship for output in his final plant. Also the price anticipations for inputs do not include the raw product input except in the first plant. If the anticipated variability is comparable, this means that the vertically integrated firm will come to equilibrium at a larger output in each plant than would individual firms performing the separate functions of each plant, because uncertainty discounts on anticipated output revenues and uncertainty premiums on anticipated input expenditures will be applied fewer times in the vertically integrated firm. It is possible, with the right market

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[1] Assuming the entire product is carried through all plants with no sales made except from the final plant. If there are by-products from some plant, or if one plant is operated at a size which utilizes more than the complete output of the others, additional markets will concern the firm and additional anticipations of price-quantity relationships will be necessary.

conditions, for the vertical integration to decrease the elasticity of the supply and/or demand functions facing the firm, especially where the integration is accomplished through a joint plant. When this is true the opposite effect--equilibrium at a smaller output in the vertically integrated firm--may offset the effect of the reduced uncertainties, even though they are further reduced by the increased market power.

When several firms operate a single plant jointly, as compared to each firm carrying out the same function individually, the uncertainty or anticipated variability of the expected price quantity relationships, as well as the variability in other expectations, facing each firm is ordinarily reduced. This is due to the fact that the pooling process which takes place in the joint plant reduces the variability facing each firm by averaging or spreading the uncertainties. As has been pointed out this uncertainty of expectations facing each participating firm is often reduced further by pooling between departments and over time in the joint plant. Such reduction in the variability of expectations for each participating firm also has the effect of increasing the dynamic equilibrium output of each participating firm because uncertainty discounts and uncertainty premiums are reduced. It will also have the effect of increasing the length of the planning period for each participating entrepreneur.[1]

[1]Cf. Lange. Price Flexibility. . . . p. 32.

The participating entrepreneur must also consider his anticipations of the attitude and behavior of the other entrepreneurs participating in the joint plant. In the first place, since the relevant segment of the marginal cost function (and if a joint marketing plant, also of the marginal revenue function) in the joint plant to each firm is the segment starting with the sum of the outputs of all participating firms, whenever per unit costs vary sufficiently with volume in this range, a change in the output of one participating firm will throw the others out of equilibrium. Therefore, under dynamic conditions, each entrepreneur must consider not only the current output of the others, but also his expectation of changes the others will make in their output in the future. Uncertainty of this expectation introduces an additional uncertainty premium causing an intertemporal substitution against the more current inputs and against the more distant outputs of the participating firm as well as substitution against the joint plant activity.

Secondly, the fact that decisions concerning the joint plant are made by the participating entrepreneurs as a collective group means that each faces some uncertainty as to these decisions and whether or not they will be made in the best interests of his individual firm. As long as each anticipates that the interests of most of the others correspond to his own, and that a minority with conflicting interests will not dominate the majority, the uncertainty

premiums and discounts, arising from participation in the joint activity will be rather small. If an individual participating entrepreneur expects the interests of the majority to conflict with his own, or that a minority with opposing objectives will dominate in the decision making, he will participate in the joint plant only if he anticipates sufficient gain by doing so to compensate for this uncertainty. This required anticipated gain may be substantial to such an entrepreneur, particularly if long time production plans are required in the joint plant. The anticipations of each participating entrepreneur relative to the continued participation of the others affect his production plan in the same manner.

The firm which participates in a common plant jointly with others must consider the discounted anticipated most probable value and the anticipated variability of future relationships in order to arrive at the production plan which maximizes the discounted value of the expected profit stream. This is true for all firms under dynamic conditions. The participating entrepreneur must also consider the effect participation in the joint plant has on these anticipations in determining both the best production combination and the optimum output, in terms of the efficiency objective, for the firm in each operating period.

C. Adjustments to Uncertainty

The second assumed objective of the participating firm in a dynamic setting is to minimize the variation in the anticipated profit stream over time. In order to achieve this objective, the entrepreneur, given his expectations and anticipated dispersion around each expectation, selects the production plan which provides for the most economic adjustment to the uncertainties.[1] While this objective and the maximization of the profit stream objective previously discussed are distinct objectives, the two are interrelated. It has been noted that uncertain expectations introduce uncertainty premiums and discounts which must be considered under the profit maximization objective. Likewise, the costs of making adjustments to uncertainty must be taken into account under the variation minimization objective. The two objectives ordinarily lead to different optimum positions, however, and must be considered jointly in order to establish the final equilibrium position.

An important consideration under this second objective is flexibility within the firm. Considering the anticipated dispersion around his most probable expectations, the entrepreneur chooses the production plan which, while not optimum

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[1] Even with certainty, price variations, varying output, technological progress, etc., give rise to this second objective. Cf. Hart. op. cit., p. 9-50, and Stigler, George. Production and Distribution in the Short Run. Journal of Political Economy. 47:305-327. 1939.

for the most probable expectations, is optimum considering the probable variations around these expectations. Under the objective of minimum variation in the expected profit stream alone, the entrepreneur will maintain flexibility within the firm to the point where the expected marginal gain in flexibility is equal to the expected marginal cost of obtaining the flexibility. It is possible that under this objective it will be economic to organize for flexibility in production to the point where the average cost function is horizontal over the entire relevant range. How far a given firm will go in this direction depends upon the technical conditions of production, the anticipated variations involved, and the costs of achieving the flexibility. Up to a point such flexibility in organization and operation of the firm is likely to be consistent with the maximization of the profit stream objective.[1] In the Stigler cost diagram, for example, production along the flatter average cost curve may return a bigger stream over a period of time, considering variations in output, than production along the average cost function with the lowest minimum point.

Flexibility in production and adaptability to change are obtained in several ways. Equipment which can readily be changed over to other specific uses, organization into units, each of which can be brought into production independently,

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[1] Stigler, op. cit., p. 317.

and machines which operate at a fairly high efficiency over a substantial range of production rates all make for increased flexibility. A high ratio of variable costs to fixed costs indicates more flexibility than a low one. Similarly a high ratio of relatively liquid assets to relatively fixed assets within the firm means a relatively flexible organization. Labor trained to perform many of the different types of duties in the plant also increases flexibility and adaptability. Minimizing the production lag has the same effect. If the marginal cost of making these adaptations within the firm is relatively low, and the marginal gain in flexibility relatively great, the organization toward flexibility will be carried out much farther than if the costs are relatively high and the gain if flexibility relatively small.

Another important consideration in minimizing the expected variation in the profit stream to the firm is diversification of production. To be consistent with the stability objective, the firm will diversify in the directions and to the point where the expected marginal gain in stability over time from diversification is equal to the expected marginal cost of the diversificiation. The firm may diversify in the types of output, by vertical integration of production of each output, in the types of inputs utilized by the firm, and in the organization of the technical production process. A given entrepreneur will determine the diversification most

useful in his firm on the basis of the technical production functions and the input and output markets facing the firm as well as his anticipations as to the costs of diversifying and the gain in intertemporal stability from diversification.

A third consideration for minimum expected variation in the profit stream through time is the special kind of diversification where production activities are selected which, when taken together in combination, minimize the anticipated dispersion around the expected most probable profit level. The use of uncertainty discounts and premiums will not automatically define such a production combination because anticipated dispersion of one variable may offset the anticipated dispersion of another. This objective considered alone, dictates that the firm avoid "risky" activities unless the expected variations in the profitability of one of the activities are anticipated to be counter-cyclic to the expected variations in the profitability of one or more of the other activities, as might be true, for example, in vertically integrated production. Again the cost of such organization in production must be considered.

The final consideration for the objective of stability of profit over time to the firm which will be mentioned is research and similar programs in order to keep abreast of technological innovations. The firm will expand such programs to the point where their anticipated marginal productivity in terms of increased profit stability is equal to

their anticipated marginal cost, and will select the specific programs which are expected to be the most productive from this standpoint. If the demand curves facing the firm are relatively inelastic, the firm will concentrate on cost reducing innovations, and on more effective advertising schemes, but if the demand curves for outputs are perfectly elastic the firm will concentrate on both cost reducing and output increasing innovations, and do nothing in the way of advertising schemes. The firm will attempt to find new ways of substituting against inputs with supply curves which are inelastic to the firm and particularly those whose supply curves are expected to become more inelastic. The firm may conduct its own research program, it may contract with research agencies, it may depend upon rapid adaptation of public research findings, or it may emply various combinations of these and other methods depending upon the expected marginal productivity and marginal cost of each.

If the firm is faced with markets where inputs are rationed to it, where the outputs which can be marketed are limited, or where prices or margins are fixed, the firm is less flexible to unpredictable changes in conditions which affect it than is the case in the absence of these imperfections.[1] Therefore the organization within the firm which minimizes the effect of these market imperfections is also a

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[1] See Hart. op. cit., p. 33-50.

necessary condition for consistency with the stability objective. The most common and most important market imperfection from the standpoint of many firms is capital-rationing.[1] In general the above conditions for stability over time within the firm lead to a reduction in capital-rationing. For example, organization for flexibility is brought about by relatively high liquidity. The same is ordinarily true of diversification and also of adequate insurance coverage. It is possible, however, that capital-rationing may be reduced still farther by adjustments in addition to these conditions for stability. Corporate legal structure, for example, has this effect, and to a more limited extent this is true of the partnership. To a given firm other types of adjustment may also reduce capital-rationing. Again, if the adjustment is to be economic to the firm, the marginal cost of making the adjustment must not exceed the marginal gain from the decrease in capital-rationing.

So much for the adjustments for stability of profits over time as applied to the firm generally. What specific applications must be made when the firm participates in a common plant jointly with other firms? First of all the group of participating firms should consist of those firms with the minimum divergency of interest, so as to minimize the anticipated conflict of interest among the several

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[1] For an excellent discussion of capital-rationing see Hart. op. cit., p. 39-49.

participating entrepreneurs. Specification of the conditions of participation in the articles and by laws of the association will also help to minimize this anticipated conflict of interest and the uncertainty of continued participation of the other firms. The participating firms move in the direction of minimizing this divergency of interest among them up to the point where the expected marginal gain is equal to the expected marginal cost.

Participating firms may gain stability by integrating vertically, and will do so, as long as the expected marginal gain in stability exceeds the marginal cost of the integration. By operating a common plant jointly, additional processes, which require a large size for economic operations, become economic to firms which are not of sufficient size to carry out the integration individually. It is common for several such groups of cooperating firms to carry the vertical integration still further by federating and operating a single plant jointly as a part of the activity of each of the groups. Not only is the vertically integrated operation likely to be more stable in view of temporary fluctuations in market conditions, for the reasons pointed out above, but because of the higher degree of coordination of the various processes, it is likely to be more adaptable to changing technical and economic conditions affecting the firm. The diversification which results also decreases the anticipated variability of profits over time to the participating firm.

In addition, the participating firms may gain stability by diversifying horizontally both in the joint plant and in their individual plants. Where there are several departments in the joint plant, all of which are integrated with the individual activities of the participating firms, the anticipated stability of profits over time for each participating firm will ordinarily be greater than in the absence of such diversification. This is particularly true where counter-cyclic fluctuations are expected among the activities and outputs of the firms.

The opportunity to pool uncertainties within the group of participating entrepreneurs has already been mentioned as a source of increased anticipated stability of profits over time to each firm. Such opportunity arises solely from the fact that the firms operate a common plant jointly and relates specifically to uncertainties growing out of associated production activities. Because the joint activity is associated with the individual activities of each firm, however, the resulting anticipated profit stability affects the entire operations of the participating firms. As was pointed out in chapters 5 and 6, these uncertainties, even though specific to a given department or operating period, may be pooled between departments and over time. This has the effect of reducing the expected profit variability for each firm, and will be carried out as long as the expected gain in stability is greater than the expected cost of the pooling

process for the majority of the participating firms.

By participating in a joint plant, firms are often able to reduce capital-rationing to themselves. Those firms with limited capital resources typically are both willing and able to obtain larger amounts of total borrowed capital as result of their participation in the joint activity. There are several reasons for this. They are able to obtain credit as a group for the joint activity as such, even though some of the participating firms individually are unwilling or unable to obtain the use of any more capital. The structure provides machinery whereby participating firms with a high marginal productivity for capital may borrow from those with a low marginal productivity for capital. Firms are willing to borrow more capital because they jointly assume the anticipated additional uncertainties arising from the additional borrowed capital and expanded production activities. The chief result of the reduced capital-rationing is that it provides for an increase in expected economic efficiency for each participating firm without a corresponding decrease in the expected profit variability over time, and vice versa.

In order to be in equilibrium under the objective of maximum stability of the profit stream over time, the participating firm must allocate resources and plan production so that the expected marginal gain in stability over time is equal to the expected marginal cost of attaining the stability. The ratio of the expected marginal gain in

stability to the expected marginal expenditure of organizing for stability must be equal for all methods used by the firm to achieve stability over time. It must be impossible to increase expected stability by using a method not being used or by discontinuing a method which is being used. This equilibrium position must be stable in the sense that if the firm is thrown out of stability equilibrium, adjustments to again meet the necessary conditions will cause conversion to equilibrium.

D. Efficiency and Stability

Given the production plan which maximizes the discounted value of the expected stream of profits and the production plan which minimizes the expected dispersion around the most probable profits over time for a participating firm, the task is resolved into the selection of the best compromise position between these two. The location of this compromise position for a given firm will depend upon the "technical" relationship between these two objectives and the indifference map of the entrepreneur defining the relative importance of the two objectives to him. If both the technical relationship and the indifference map are assumed to be definite and clearly defined and without discontinuities, a unique optimum position will be described by the point of tangency of the technical relationship function and an

indifference curve between these two objectives.

The indifference map between efficiency and stability is purely subjective in that it exists only in the mind--perhaps even somewhat unconsciously--of the particular entrepreneur. It is reasonable to expect that individual entrepreneurs have different indifference maps, and that the map of a particular entrepreneur may change over time. Some entrepreneurs are obviously more venturesome than others, not only because of their attitude, but because of differences in the ratio of net worth to total assets among otherwise similar firms. An individual's attitude toward "risky" business ventures may change as his general attitude shifts from motivation by depression psychology to motivation by inflation psychology. It also seems reasonable to expect that differences between entrepreneurs, and differences over time for a given entrepreneur may cover a limited range. Willingness to assume entrepreneurship alone indicates something of a venturesome spirit. On the other hand the fact that economic horizons are limited and that security has a positive value indicate that some anticipated reward is required as inducement for bearing additional uncertainties. It is probable that some convexity toward the origin, as is typical of the usual indifference curve, and some negative slope in these indifference curves represent the case realistically.

The technical relationship between efficiency and stability involves subjective elements also, and is likely to vary somewhat between entrepreneurs and over time. Both objectives are based on anticipations, not only as to most probable values but also as to dispersions around these most probable values. Both consider anticipated technical production functions, anticipated market conditions, and anticipated technological innovations. In case of the participating entrepreneur both consider anticipation as to the attitudes and behavior of other entrepreneurs participating in the joint activity. The nature of this relationship depends upon the amount of expected efficiency sacrificed (or gained) as expected stability is increased in the firm, and vice versa. It is logical to suppose that over a limited range as expected efficiency is improved expected stability is also increased. Movement toward the best combination of outputs at the least cost combination from the standpoint of efficiency will probably be complementary with increased stability up to some point. Then there will probably be a limited range over which optimum efficiency will be independent of maximum stability. Finally there must be a range within which any further gain in expected economic efficiency comes only at the sacrifice of expected stability over time. The same three stages are probably also passed through as stability over time is increased. In this case as long as the two objectives are technically complementary,

or as long as either efficiency or stability can be increased without sacrifice of the other, the firm will improve its position by moving out along the curve away from the axis regardless of the nature of the indifference map.[1] The range of this curve which is crucial for determining the optimum position of the firm is only that segment of the curve where optimum efficiency and optimum stability within the participating firm are competitive.

The optimum position for a given firm under dynamic conditions considering the two economic objectives is visualized in Figure 9. Efficiency is measured on the X axis increasing to the right and stability is measured on the Y axis increasing upward. The technical relationship between efficiency and stability is represented by the curve ABCDEF. Optimum efficiency is represented by OK on the X axis and maximum stability by OS on the Y axis. The indifference curves I, II and III represent the series of efficiency-stability points toward which the entrepreneur is indifferent. The indifference curves increase from the origin so that III is the highest one shown. The best position is defined by the point of tangency of the ABCDEF curve and indifference curve III at OJ efficiency and OR stability over time.

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[1] Unless of course, the indifference curves turn back on themselves in the relevant range which is indeed most unlikely.

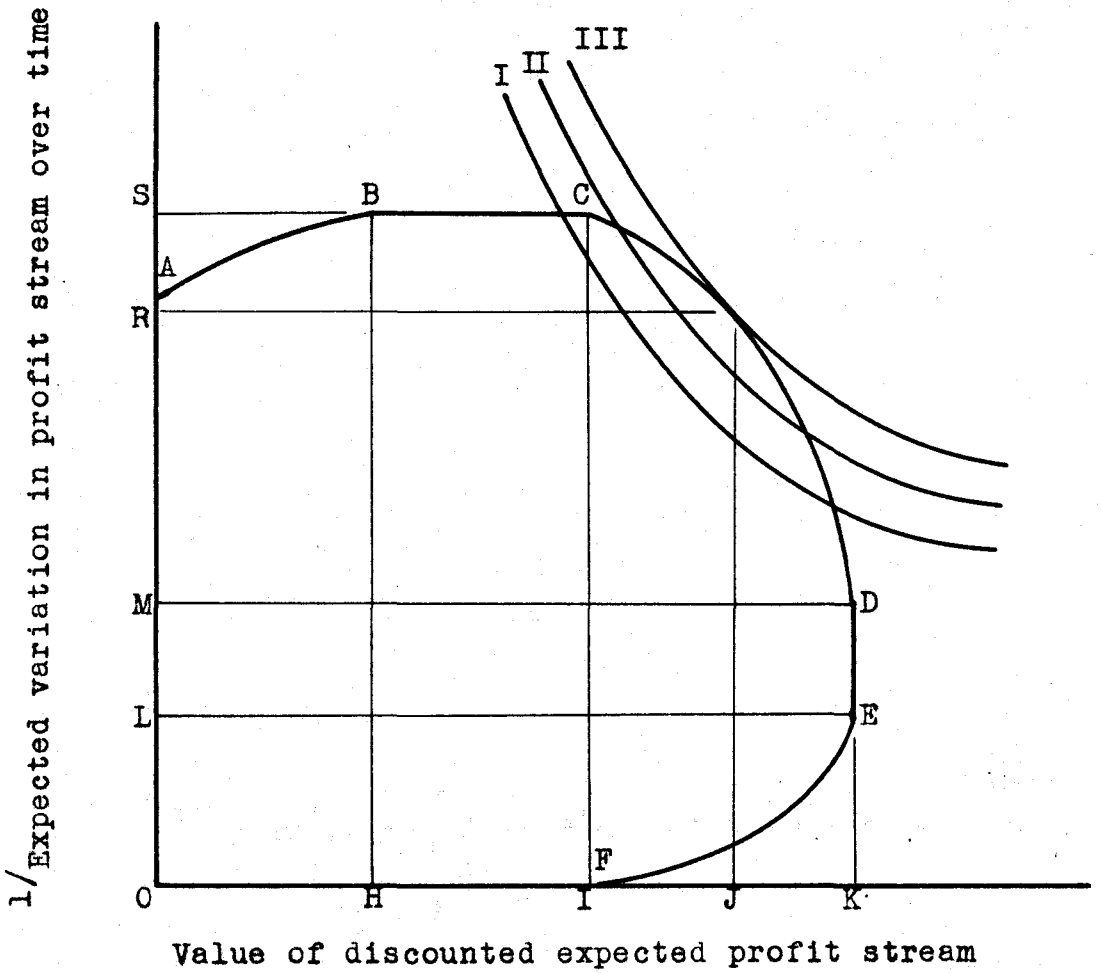

Figure 9. Relationship between efficiency and stability objectives.

The segments of the technical efficiency-stability relationship curve AB and FE represent ranges of complementarity. As efficiency is increased from O to H stability is increased from A to S, and as stability is increased from O to L efficiency is increased from F to K. The two extremes of the curve reflect the probable case of decreased stability at very low efficiency and decreased efficiency at a very unstable organization. The segment BC represents the increased efficiency from H to I with no sacrifice (nor gain) in stability, and the segment ED represents the increased stability from L to M with no loss (nor gain) in efficiency. The arc CD represents the competitive range where every increase in efficiency means a corresponding loss in stability and vice versa. The exact optimum position between C and D can only be defined by the indifference curves of the entrepreneur. All points to the left of C and below D are irrational regardless of the slope of the indifference curves; the firm will always produce at least at OI efficiency (with OS stability) and at least with OM stability (at OK efficiency).

The technical relationship between efficiency and stability shown in Figure 9, ABCDEF, seems to represent the situation with respect to the firm participating in a common plant jointly with other firms quite realistically. The example given on page 122 illustrates a gain in efficiency without loss in stability by sharing specific price

uncertainties over time, and would represent a movement along the technical relationship function from B toward C in Figure 9. Movement along this curve from A to B, with actual gain in stability as efficiency is increased, might well represent the firm's original decision to participate in the joint plant. The efficiency gain is illustrated by movement from TMC' to TMC for firm 1 in Figure 7. The stability gain arises from the opportunity, as a result of participation in the joint activity, that the firm has to pool the uncertainties in connection with the coordinated activity with the other participating firms and thus reduce the anticipated dispersion around the most probable expectations as they face the firm.

As an example of movement from F toward E along this technical relationship function, which represents a gain in efficiency as stability is increased, consider the case of diversification horizontally in the joint plant by adding a department which is also integrated with the activities in the individual plants of the participating firms. Suppose that the new department is added to take full advantage of the expected counter-cyclic movement of the uncertain price changes of the product of the added department compared to those of the product of the old department. In this case the expected gain in stability is readily apparent, and it may be accompanied by a gain in efficiency such as is illustrated in Figure 5A by movement from LATC' to LATC.

Organization for flexibility in the production activities conducted in the joint plant up to a point may represent a gain in stability without a corresponding loss in efficiency, as represented by movement from E to D in Figure 9. The installation of a processing machine in the joint plant which cuts total production time from one month to one week, and at the same time neither increases nor decreases total per unit processing costs is an example. A gain in stability results from the reduced production lag, and no corresponding sacrifice has been made in efficiency. The rational section of the stability-efficiency function, CD, is illustrated by reorganizations to gain stability in the participating firms which result in the loss of efficiency, such as the use of labor to sack mixed feed rather than automatic sacking equipment in a joint feed processing plant. And alternatively this segment of the stability-efficiency function represents reorganization to gain efficiency at the expense of stability in the participating firms, such as the purchase and operation of a fleet of motor trucks rather than the use of common carriers in a joint potato marketing plant.

Under dynamic conditions the firm which participates in one or more plants jointly with other firms will always equate the ratio of the expected discounted marginal expenditure for each input to the expected marginal physical productivity of the input times the expected discounted marginal return for all outputs in the firm (both within and

outside the joint plant) so long as no stability is sacrificed by doing so. Considering the entire operations of the firm, each participating entrepreneur will produce at the total output which equates the discounted expected marginal revenue for each output with the discounted marginal cost of the output so long as it means no sacrifice in efficiency. The participating firm will also utilize all methods of achieving stability within the total firm to the point where the expected marginal gain in stability is equal to the expected marginal expenditure for each method, and for all methods taken together, so long as it means no sacrifice in efficiency. When efficiency and stability become competitive, the participating entrepreneur will choose the production combination and the total output in each period which enables him to reach the highest possible stability-efficiency indifference curve.

XI. LEGAL FORM CONSISTENT WITH ECONOMIC STRUCTURE

In many respects the existing legal structure for cooperative associations fails to reflect adequately their true economic nature. In general the enabling statutes under which cooperative associations incorporate are patterned after the enabling laws designed for the corporate firm. Although various modifications have gradually been introduced into these statutes in order to more nearly adapt them to the distinctive nature of the cooperative association, they still leave a great deal to be desired. In this country the incorporated cooperative becomes a legal person which exists separate and apart from the participating firms. The full corporate privileges are conferred upon the cooperative association. These privileges include life apart and beyond that of any one of its members, full power to transact business in its own name and enter into contracts with third parties, liability to creditors only to the extent of actual capital allocated to the cooperative by the participating firms, and, within some limits, power to allocate earnings in any manner specified in the articles of incorporation or bylaws or by the board of directors. Such laws tend to throw the cooperative into the framework of an independent firm set up and operated by individuals who do business at the cooperative. They assume that participating entrepreneurs set up a separate <u>economic</u> entity between their individual firms

and the relevant market either for outputs or inputs of their firms. Under such a framework the entrepreneurs who own and control the cooperative are placed in the paradoxical position of maximizing profits in their cooperative by transacting business with their own individual firms in which they are also seeking to maximize profits.

In other countries, such as Denmark and Holland, the cooperative association is looked on legally pretty much as a partnership. The cooperative in this case does not exist apart from its members' firms, and these firms are jointly and separately liable to the creditors of the cooperative association. Legally however the cooperative is still considered a firm owned and controlled by its patrons. The participating firms are still faced with the same paradox. In either case the vertical integration of sovereign units through a jointly owned and operated plant is not adequately recognized. The cooperative is treated simply as a special kind of jointly owned firm which fits into the legal framework of the corporation or the partnership, or some sort of hybrid between them.

Where laws provide for the incorporation of cooperative associations on a capital stock basis, as distinguished from the non-stock form, the tendency to ape the corporate structure is even greater. The common and preferred stock and other securities of the capital stock cooperative are given the same legal form as the same security in the corporation,

except that usually the shares of voting common stock which can be held by any one individual is limited, the ownership of the stock is controlled, and the stock dividends are usually fixed. Actually the economic nature of common and preferred stock in the capital stock cooperative is considerably different from the economic nature of the common and preferred stock in a corporation or joint stock company.

A legal form consistent with the basic economic nature of the cooperative association must give recognition to the fact that separate economic units carry on a part of their total economic activities jointly and coordinately in a common plant. It must provide for this associated activity without divorcing it from the separate activities of the participating firms. It must provide for equitable participation in all economic relationships incident to the joint activity by each participating firm, and give each entrepreneur reason to believe that the other participating entrepreneurs will also participate equitably in these relationships. It must provide independence to each participating entrepreneur relative to his individual activities which are vertically integrated with the jointly conducted economic activity. And finally it must provide a framework which enables the participating entrepreneurs to operate the joint plant in their own best interests considering the entire vertically integrated activity of each participating firm.

An enabling act which recognizes the basic economic

nature of the cooperative association will not do the educational job of making all participating firms understand the full implications of the cooperative structure. It will not, however, stand in the way of such an understanding, and sound entrepreneurial action based on such understanding, as present enabling laws tend to do.

A. Articles of Association

When a group of firms form a cooperative association for purposes of conducting a part of their business activity jointly, the enabling legislation should provide for the filing of "articles of association" rather than articles of incorporation. The participating firms should be "associated" with respect to their joint activity, but their joint activity as such should not be incorporated. The cooperative should legally as well as economically be a group of individual firms functioning coordinately with respect to a part of their total activities rather than a jointly owned sovereign and unattached enterprise such as the corporate firm. The cooperative should legally exist only as an integrated part of the respective business activities of the several member firms.

Legal "association" should give the joint activity perpetual life, either directly or by providing for charter renewal. It should provide machinery for firms to withdraw from and to join the association without jeopardy to the associated

activity as such. It should give the association the power to transact business with third parties in its own name, the right to own property, including real estate, and the right to sue and be sued in its own name. It should provide for an ownership capital fund which is allocated to the associated activity. It should provide for a board of directors and decision making machinery for the association. It should provide that the signature of the president and secretary on official documents, contracts, agreements, etc., shall legally bind the association and its members to the extent authorized, as specified in the articles of association. All of these things should be provided in a manner which recognizes the coordinate functioning of sovereign units--the participating firms.

The joint activity should not be incorporated as an entity existing apart from the participating units. The ownership capital fund in the cooperative association should represent a part of the entrepreneural capital of each participating firm, which is allocated by each of them to their joint activity. This capital is productive to the participating firms because they use it to further their own economic activities. The residual ownership capital in the cooperative association should therefore carry no vote and draw no interest nor dividend. Any return to such capital would add an equal amount to production costs and so would be simply a bookkeeping transaction. The enabling statute should not ape

the capital stock structure of the corporate firm. There is no capital in the cooperative association comparable in economic nature to either common stock or preferred stock in the corporation. These forms and terms should not be used in the laws for association. An example of suitable terms for the residual ownership capital in the association is given in the appendix to this chapter. The economic nature of bonds is the same in both cases and the same terminology can and probably should be used.

In contrast to incorporation, legal association should prevent representatives of the participating units from serving in salaried managerial capacities in the cooperative. Unlike corporate managerial personnel, association managers carry no entrepreneurial responsibility for the business. Instead they are skilled business or functional technicians for the specific activity carried on in the association whose salary is based on their marginal productivity in their employment. Not only do their abilities, responsibilities, and duties differ from those of the participating entrepreneurs, but their interests are primarily limited to the joint activity as such rather than to the entire integrated production of the participating firms. The legal structure consistent with the economic nature of the cooperative association will therefore draw a sharp line between the management function and the entrepreneurial function in the joint activity.

Legal association should not permit large accumulations of unallocated reserves and free surplus in the joint activity as an alternative means of obtaining capital. Such a policy would be likely to force uneconomic allocation of capital within the participating firms toward the joint activity. In the first place the department or plant earning new capital for a firm has no special claim on that capital. The entrepreneur will allocate such capital wherever he anticipates it will be the most productive. Secondly, in an integrated firm such as those participating in the joint plant, accounting procedure alone can determine which departments or plants appear to be most profitable. As a practical matter, because of uncertainties and imperfect knowledge, a small reserve should be built up in connection with the cooperative association. Such reserves should serve as a hedge against the uncertainties of high costs in the joint plant and as a means of spreading or pooling these uncertainties over time rather than as a source of capital to finance expansion as in the corporate firm. There should be statutory limitations, with provision for some flexibility in the articles of association, on the amount of such reserves in the cooperative association, and provision should be made to revolve them when they reach this limitation.

Finally the enabling laws should provide for more limited powers of the board of directions in the association than in the corporation. Because of the integrated nature of the

associated activity and the individual activity of the participating firms, the chance of conflicting views and interests is greater among the participants in the cooperative association than among the stockholders of a corporation. Even though all members of the board of directors are entrepreneurs of participating firms, legal provision must be made for an adequate check and balance system in the cooperative association. The enabling legislation should provide for referendum and for machinery for calling special meetings of the participating entrepreneurs with authority to modify board policy and to replace board members, officers and employees of the joint activity if necessary. Minority interests should be given more adequate recognition and protection in the association than in the corporation.

B. Proportionate Liability

Because the joint activity is an integrated part of the production activities of the participating firms, legal "association" should not provide for liability of the participating firms which is limited only to the extent of the capital they have allocated to the joint activity. Such a provision fails to recognize the integrated nature of the associated activity and the individual activity of the participating firms. It tends to force the associated activity into a form of organization and method of operation which are entirely

inconsistent with its basic economic nature. It tends to establish hurdles to the economic allocation, and constant reallocation as conditions change, of capital between the joint plant and the individual plants within each participating firm.

For complete consistency with the economic nature of the cooperative association, the participating firms should legally be liable for the debts of the association, not only to the extent of their capital allocated to the joint activity, but to the extent of the entire net worth of the firm if necessary. Each individual participating entrepreneur, however, should be liable only for the proportionate share of the joint activity included as a part of his firm. Each should not individually have unlimited liability for the debts of their association. For example a firm representing one percent of the total joint activity should legally be liable as a firm for one percent of the claims against the joint activity as such.

When the association is thus legally backed not only by the assets allocated directly to the joint activity, but proportionately by the entire assets of each participating firm, the association is on a basis which is much more sound. The associated activity is legally recognized as an integrated part of the total operations of each participating firm. And yet each participating firm is protected from the inequities of unlimited individual liability for the whole joint activity.

Also the independence of that part of the total activity of each participating firm outside of the associated activity is recognized.

C. Economic Relationships

The proportionality concept, as the guide by which participating firms share the economic relationships arising from their joint activity, should be given legal recognition in the enabling statutes. Yet proportionality should not be required by law to the point where it causes economic inefficiencies in view of conditions such as differences in the marginal productivity of capital among the participating firms, short time fluctuations in the proportionate participation by the associated firms, departmental differences in the joint activity, and high costs of determining exact proportionality of participation. The enabling statute should set the pattern for the proportional sharing of the economic relationships but provide enough flexibility so that a given association can, in its articles of association, make adaptation to its peculiar conditions.

Proportionality should be defined in the enabling legislation as the percentage use made of the joint activity by each firm on the average over several operating years. This should be a moving average which adjusts quite quickly and accurately to secular changes in percentage participation by

each firm. Special provision should be made for new firms joining as participants in the joint activity that have not yet established a moving average as a basis for the determination of percentage participation. Legal provision should be made for the option of defining proportionality separately by departments when there is more than one department in the joint plant so that in associations where important departmental differences exist they can be recognized.

Participating firms should legally be required to share the financial responsibility for the joint plant on a proportional basis as a condition of participation. This does not mean that they should be required to allocate capital directly to the associated activity or the several departments of the associated activity necessarily on a strictly proportional basis. An allocation of ownership capital is an amount determined by the requirements of the joint activity should be required as a condition of participation. Provision should be made, however, for the individual firm to provide only a part of this capital in cash and sign a note for the rest to be paid at some later date ordates with interest, when such procedure will improve efficiency in a given association. To offset this, provision should be made for other participating firms with capital that has a low productivity in their individual plants to provide capital on a disproportionate basis for a fixed interest rate at a level determined by the circumstances in a particular association. The

participating entrepreneurs will still assume the financial responsibility on a proportional basis by agreeing to pay whatever rate of interest is necessary to induce this capital, and that invested by the public, to move into the associated activity. Provision should be made to readjust the required ownership capital allocated by each participant as proportionality changes.

Provision should be made for the use of revolving fund financing at the option of each association. The law should permit revolving funds of patronage deductions, patronage refunds or any other allocation of capital to the joint activity by the participating firms on a proportional basis, either for the association as a whole or by departments. Each participating entrepreneur should be given revolving fund certificates as evidence of his equity in the revolving fund. Such certificates should carry no due date and draw no interest. In order to maintain proportionality over time the law should provide that the oldest revolving fund certificates be retired first.

The participating firms should share the control of the associated activity on a proportional basis also. This means that the individual authorized to represent each participating firm should have the number of votes determined by the percentage of the total activity represented by the participation of his firm. As outlined above, this percentage participation should be based on a moving average of the last several years.

Provision should be made for voting proportionately by departments in those associations where it is desirable to do so. Provision should also be made in the enabling legislation for equal voting by the participating firms as an alternative choice to each association. Such provision is necessary to allow equal voting in cases where it is an adequate and economic approximation to proportional voting, as will be the case, for example, where the variation in percentage participation varies more from year to year for the same firms than it does between firms in any given year. The law should require that the method of sharing voting control in each association be clearly stated in its articles.

The required quorum should be a reasonably large percentage of the total eligible votes, so as to prevent domination in control by a small group. Notice to all participating firms of the policies to be decided at each meeting should be required in the enabling code. A simple quorum majority will be sufficient in determining the more routine policies, but important decisions, such as amendments to the articles or bylaws should require the positive vote of a larger majority than this in order to become effective.

The law should provide that all costs be shared proportionately by the participating firms, either for the association as a whole or by departments in the association. Alternative methods of operating the associated activity at cost to the participating firms and of dividing these costs

between them proportionately should be provided. Assessment of costs directly, a pooling operation, or a purchase and sale operation should be made equally acceptable under the law. Any settlement between the participating firms and their associated activity at time of transaction should be legally recognized as purely tentative and only approximate until actual costs are determined and adjustment to these costs is made. The enabling statute should require that the method of adjusting accounting transactions with participating firms to a cost basis and the method of proportionately sharing such costs shall be specified in the articles of association.

The participating firms should be required to share the costs of the general reserve mentioned above on a proportional basis not only in a given operating period but over time as well. The enabling legislation should not only provide statutory limitations on this reserve in the cooperative association, but also that, after the reserve has reached this limitation, current deductions for the reserve shall be used to retire the oldest contributions to the reserve. This is necessary in order that current participating firms, as well as those in the past, bear their proportionate share of all costs in connection with the joint activity.

Many of the provisions suggested in this chapter are incorporated to a varying extent in present enabling laws. However, present laws do not take adequate account of the

fact that the joint activity is an integrated part of the separate activities of all participating firms, and that the participating firms operate the joint plant only to maximize profits to their respective firms. The enabling laws in this country make the cooperative association a corporation under the law, while those of some foreign countries consider it a partnership. As has been seen, neither legal concept reflects the basic economic nature of the cooperative association. The legal concept of "association" with the provisions suggested here would do so.

D. Appendix to Chapter XI. Model Code for Cooperative Associations

This model code is included in order to illustrate an enabling statute for cooperative associations which adequately recognizes the basic economic structure of the cooperative, and the relationships between the member firms participating in the coordinated activity. It by no means represents the only set of provisions which would legally recognize the economic nature of the cooperative, but instead is one example. In this model code little attention is paid to the practicability or workability of the provisions. The intention here is to illustrate provisions consistent with the economic nature of the cooperative association, not to draw up the ideal practical law which could be written into enabling statutes as such. Only those provisions which relate to the organization and operation of the association of cooperating firms are included. No pretense has been made of expressing the provisions in legal form or language. From this point of view the wording is no doubt ambiguous and indefinite at points.

1. Cooperative associations

1. Applicable. Any group of two or more corporations, partnerships, or individual proprietorships, or any combination thereof, or any group of two or more cooperative

associations, or any group of two or more consuming units may associate and organize a cooperative association under this chapter, provided:

a. The units associate for the purpose of jointly and coordinately conducting some activity which is, or thereby becomes, functionally integrated with the business or consumption activity of each participating unit.

b. All other provisions under this chapter have been met.

2. Articles of Association. The articles of association must be filed with the Secretary of State and duly recorded in the county where the home office of the association is located. The life of an association registered under this chapter shall begin upon receipt of certification from the Secretary of State and the mailing of such notice to all members by the secretary of the association. The articles of association shall be signed by a duly authorized representative of each of the original associating firms, associations, or households, or by the members of the board of directors as representatives of these units. They shall contain nothing which violates any section of this chapter. They shall provide:

a. The name of the association, which must be suffixed by the word "Associated", and the address of its principal office.

b. The purpose for which the association is formed as related to the activities of associating firms (for example, "to provide, manufacture, process, package and distribute livestock feed to be used in the production of livestock and livestock products by the associated firms").

c. The duration of the association, which may be perpetual.

d. The name, post office address and nature of the business organization and activities of each associating unit.

e. The number of directors, their qualifications and term of office, and how they shall be chosen and removed.

f. What units are eligible for membership and conditions essential for eligibility, how members shall be admitted and membership lost and how financing, costs, risks, control and benefits will be shared by the associated units, and how assets will be distributed in liquidation.

g. The date of the first annual meeting of the authorized representatives of the associated firms, associations or households.

3. Bylaws. If the articles of association so provide bylaws may be adopted to supplement the articles of association.

4. Amendments. The articles of association and bylaws may be adended at any special meeting as provided in section 32.

5. Powers. An association organized under this chapter

may enter into contracts and conduct business in its own name, may hold property including real estate in its own name and may sue and be sued in its own name.

6. Proportionate Liability. The firms, associations or households which participate in an association organized under this chapter shall be proportionally liable for the debts of the association. This liability shall be not only to the extent of assets of each participating unit in the joint activity, but to the extent of the entire assets of each unit, provided, however, that no participating firm, association or household shall be held liable beyond its proportionate share in the joint activity. Proportionality for this purpose shall be as defined in section 12.

7. Withdrawal of Participating Units. Any firm, association or household may withdraw from participation in an association organized under this chapter at the end of any accounting year by filing written petition with the secretary of the association not less than sixty days prior to the end of such accounting year. Such withdrawal shall date from the close of the current accounting year and shall become effective after being presented at, and duly recorded in the minutes of, the annual meeting of the association.

8. Expulsion of Participating Units. Any firm, association or household may be expelled from participation in an association organized under this chapter at the end of any

accounting year at any special meeting of the association called for that purpose, as provided in section 32. Any participating unit failing to use the associated activity for a three year period shall automatically be expelled at the beginning of the next operating year, and shall be so notified by the secretary of the association.

9. Liability of Units which Withdraw or Are Expelled. The proportionate liability of units which withdraw or are expelled for the debts of the association shall cease when termination of membership becomes final. Such units shall not be relieved of any existing contractual obligations to the association or to any participating units thereof.

10. New Participating Units. New units may become participating members in an association organized under this chapter beginning as of any accounting year upon signing an application agreeing to the conditions of participation and approval of such application by majority of all votes cast by the participating units represented at the annual meeting. If the articles so provide, applicants may be treated as members in all respects, except sharing proportionate liability for the association and the right to vote, dating from time of signing of application until approved by the membership.

11. Publication of Participating Units. A list of names and addresses of all member participating units shall

be entered on a membership register of the association. A copy of this list shall be attached to the annual balance sheet and operating statement report and distributed at the annual meeting. This list shall be posted at all times in a conspicious place at the principal place of business of the association.

12. Proportionality. Except where otherwise provided, participating units shall share all relationships growing out of the association on a basis proportional to the use made of the associated activity. This proportionality to use shall be calculated on the basis of the moving average of the three most recent years. If the articles of association so provide, associations operating more than one department may segregate the relationships by departments and base proportionality on the use made of each department over the most recent three years.

13. Proportionality for New Participating Units. The use of the associated activity for new participating units for purposes of determining proportionality shall be an estimation agreed upon by the new participating unit and the board of directors of the association. The second year the average of the previous year's use and this estimation shall be taken; the third year the average of the two previous years and this estimation shall be taken; and thenceforth the average use in the three most recent years as provided in section 12 shall be taken.

14. Control. Control over the associated activity shall rest solely with the participating units, directly and through their elected board of directors.

15. Voting. Only authorized representatives of the participating units listed in the membership register shall be eligible to vote on affairs of the association in annual and special meetings. Voting shall be on a proportional basis as explained in section 12, either for the activity as a whole or by departments as provided in the articles of association, except that, if the articles provide, voting may be done on an equal basis as an approximation to proportionality.

16. Board of Directors. If more than ten units participate in the association, a board of directors shall function for the association. Directors shall be elected by the duly authorized representatives of the participating units from their number for such terms and in such manner as the articles of association provide. Where the number of participating units is ten or less, the duly authorized representatives of these units shall be considered the board of directors, except that if the articles of association provide for a board of directors in addition to this group, the board shall consist of three or more representatives elected by the group. Vacancies on the board shall be filled by board appointment until the next annual meeting. Any board member may be removed from office through special meeting procedure as

outlined in section 32.

17. Powers of the Board. The board of directors shall have those powers delegated to it by the participating units and shall have limitations on such powers as specified in the articles of association and bylaws, provided the requirements of this chapter are met.

18. Organization of the Board. The directors of the association shall transact business only as a board. Two-thirds of all directors shall constitute a quorum. All members of the board shall have one vote, except where less than ten units participate in the association, and no separate board is provided, in which case section 15 shall rule. The directors may receive such fees as provided in the articles or bylaws of the association, but shall not be salaried.

19. Officers. The board of directors shall elect a president and a secretary and such other officers as provided for in the articles of association from their own number. The signatures of the president and secretary shall be required on all official business of the association, except such routine business as may be delegated to others. Such duly transacted business shall be binding on all participating units of the association. Any officer may be removed from office through special meeting procedure as outlined in section 32.

20. Employees. The association may have a manager and

such other employees as may be necessary. Such employees shall be charged with executing the policies set by the membership and the board, and may advise regarding policy, but shall in no way set policies for the association. No official representative of any participating unit shall be an employee of the association. Any managerial employee may be discharged through special meeting procedure as outlined in section 32.

21. Finance. The participating units as a group shall assume the full financial responsibility for the association and share it on a proportional basis as defined in section 12.

22. Ownership Certificates. All participating units shall be required to allocate capital to the association by purchasing ownership certificates in the association as a condition of participation. Such ownership certificates shall be legal evidence of membership in the association. The value of such ownership certificates shall be stated in the articles of association and shall be proportional to use as outlined in sections 12 and 13. If the articles so provide, participating units may be given the alternative of purchasing such ownership certificates with cash or of providing a part of their subscription in cash and signing a note for the rest. Such notes shall draw interest at the fixed rate prescribed in the articles. These notes may be retired by periodic cash payments, patronage deductions, patronage refunds or in any other manner prescribed in the articles of association.

Ownership certificates held by any member unit shall not be retired until withdrawal or expulsion of the member unit from the association, or until dissolution, whichever comes first. No interest nor dividend shall be paid on such certificates. They shall annually be adjusted to proportionality as defined in sections 12 and 13, provided, however, that no adjustment shall be necessary unless the disproportionality exceeds twenty-five dollars or more.

23. Participant Investment Certificates. In addition to the required ownership certificates, member units may purchase participant investment certificates. These certificates shall not be available to non-participants, and shall be non-transferable. They may or may not carry a due date and will draw a fixed interest (cumulative or noncumulative) as prescribed in the articles of bylaws of the association. Their ownership need not be based on proportionality in any way. If the articles of association so provide, these certificates, or any part thereof, may be retired by the association upon favorable vote at any annual or special meeting of the membership.

24. Other Securities. If provided by the articles of association, other fixed interest bearing securities may be issued to the investing public. Such securities may be transferable or non-transferable. The interest on such securities shall be cumulative, and shall not exceed by more than three percent per annum the interest rate on U. S. Treasury bonds

at the time issued. If the articles of association so provide, these certificates, or any part thereof, may be retired at the discretion of the association.

25. Revolving Fund. If the articles of association so provide, a revolving fund may be used to provide capital in the association. The revolving fund may consist of patronage deductions, patronage refunds or any other contributions made by the participating units on a basis proportional to use. Participating units shall be issued revolving fund certificates for their contributions to this fund. These certificates shall have no due date and shall draw no interest nor dividend. They shall be retired in the chronological order issued. One revolving fund may be set up for the association, or separate revolving funds may be set up by departments where there is more than one department in the associated activity.

26. Retirement of Securities of Terminating Memberships. Participating units which withdraw or are expelled from the association shall have their ownership certificates and participant investment certificates retired within one year after their termination becomes effective. Participation investment certificates will draw their normal interest until retired. Ownership certificates will draw a fixed rate of interest in an amount specified in the articles of association from the date termination becomes effective until actually retired. Revolving fund certificates shall be retired as

paid on the normal revolving basis, without interest. Contributions to the general reserve and to contingency reserves shall not be refunded to units which discontinue participation.

27. Cost. All costs in the association shall be borne by the participating units and shared by them on a proportional basis as outlined in section 12.

28. Method of Operation. The association shall render service for the participating units at cost. Funds to meet expenses may be provided by direct assessment of fixed charges for services, by the inclusion of margins calculated to cover costs in tentative settlements, by the deferred payment or pooling method, as may be provided in the articles of association. Transactions between participating units and the associated activity shall be considered purely tentative until costs have been determined and final settlement is made.

29. Reserves. A reasonable amount shall be specified in the articles of association to be added to per unit operating costs each year and placed in a general reserve until such reserve reaches thirty percent of the total member capital allocated to the associated activity on a proportional basis. This reserve shall be drawn upon only at such times as conditions make it impossible to cover fixed costs in the association. When this reserve reaches the maximum amount, current contributions to the reserve shall be used to retire the oldest contributions to the reserve to a basis which was

proportional at the time the contribution was made. Provided however, that such payments shall be made only to units which are currently participating in the association. Oldest contributions shall be retired at not more than face value at time of contribution as shown on the books of the association without interest. In addition such contingency reserves as may be provided in the articles of association may be set up against specific contingencies.

30. Non-member Business. Associations organized under this chapter shall not transact business with non-members unless the board of directors has reason to believe that production or marketing per unit costs to participating units can be reduced by the added volume of non-member business. In no case shall the volume of non-member business exceed twenty-five percent of that of member business. Settlement with non-members at time of transaction shall be final and binding on both parties, regardless of the method of operation in the association.

31. Annual Meetings. Associations organized under this chapter shall hold an annual meeting for the duly authorized representatives of all participating units within sixty days after the close of the fiscal year for the association. All participating units shall be given not less than ten days written notice by the secretary stating the time and place of the annual meeting and any special business to come before the meeting. Representatives of participating units

representing one-half of all eligible votes shall constitute a quorum. Business shall be transacted by majority of all votes cast.

32. Special Meetings. Special meetings of the duly authorized representatives of the participating units may be held at any time including the time of, and concurrently with, the annual meeting. Special meetings may be authorized by the board of directors or by petition signed by duly authorized representatives from participating units representing ten percent of the eligible votes. Upon authorization, special meetings shall be called by the president, and the secretary shall send written notice of the time and place of the special meeting and its purpose to all participating units not less than twenty days prior to the meeting. Representatives of participating units representing one-half of all eligible votes shall constitute a quorum. Business at any special meeting shall be transacted by a two-thirds majority of all votes cast.

33. Referendum. Upon request of one-third of the directors, provided such request is duly entered into the minutes of the meeting in which the action is taken, any action of the board of directors shall be referred to a special or annual meeting for endorsement or rejection. The action of the board shall stand until rejected at the annual or special meeting.

34. Priority of Claims at Dissolution. At dissolution

the following priority of claims shall stand for associations organized under this chapter.

a. Holders of current liabilities against the association.

b. Secured lenders to the association.

c. Unsecured lenders to the association.

d. Holders of due date securities sold to the general public--shortest term first.

e. Holders of securities with no due date and cumulative interest sold to the general public.

f. Holders of participants' investment certificates.

g. Holders of revolving fund certificates.

h. Holders of certificates of ownership.

i. Those who contributed to the general reserve.

j. If anything remains it shall be distributed to the currently participating units on the basis of their average participation over the most recent three year period.

XII. PRACTICAL CONSIDERATIONS

The purpose of this chapter is to discuss some of the current issues and problems relative to cooperatives and their operations on the basis of the theoretical concepts relative to the basic economic nature of the cooperative association. In doing so the extent of the usefulness and applicability of the multi-firm plant concept to cooperative associations in practice and as an aid to the solution of practical cooperative problems will be revealed. If the concept of the basic economic structure of cooperative association, and what constitutes rational behavior within such a structure, is to be of much more than academic interest, it should shed light on practical questions and problems. To be of maximum use the concept should provide the basic orientation from which all problems concerning cooperative associations, practical and theoretical alike, will be approached and solved.

Obviously neither the so-called "principles of cooperation" nor the many and divergent "philosophies" of cooperation provide such a framework. The cooperative principles are simply descriptive organizational and operational procedures or guides. Some square with the basic nature of the cooperative, while others are irrelevant. None of them provide a consistent and useful point of departure for solving problems met in cooperative associations. Cooperative

philosophy primarily has to do with what the philosopher conceives to be the role of the cooperative association, or what he believes their role should be. In any case it provides little in the way of a basic framework for approaching actual cooperative problems. It seems logical to suppose that the concept of the economic nature of the cooperative association must provide this basic point of departure.

The practical considerations discussed here certainly do not exhaust the list. Many others could have been chosen for the illustrative intent of the present chapter. Those that are included are not methodically treated and are by no means adequately developed. They are included only to point up some of the basic issues involved and to indicate the relationship of the economic nature of the cooperative association to these basic issues.

A. The Income Tax Question

One of the most widely discussed issues relative to cooperative associations is the basis upon which federal corporate income tax is levied against them. There are two specific issues in question relative to income taxation of cooperatives in the United States; these two are frequently confused in discussions concerning the matter. The first of these is the statutory exemption of <u>eligible farmer</u> cooperatives from certain federal income taxes. The second is the

federal income tax treatment of patronage refunds made to participating firms in cooperative associations under certain circumstances.

As legal entities, farmer cooperatives which qualify are granted exemption from federal corporate income taxes, along with many other types of organizations, under Section 101 of the Federal Internal Revenue Code.[1] Under the Revenue Act of 1951, exempt cooperatives now pay federal income tax on any operating net proceeds not allocated to participating firms in a manner that would make such amounts taxable to members.[2] They are not required as corporations to pay federal income tax on income paid as dividends on stock, income from non-operating sources, income from business done with the Federal Government, incidental income and capital gains, all of which are includable in the tax calculations of non-exempt cooperative associations and other corporations.

Non-exempt cooperative associations pay federal income taxes in the same manner and at the same rate as other corporations. Patronage refunds are not exempt from income taxes at the association level by any specific statute or administrative ruling of the Treasury Department. Where prior

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[1]For a discussion of the exemption and requirements for exemption see Davis, John H. An economic analysis of the tax status of farmer cooperatives. American Institute of Cooperation. Washington, D. C. 1950. p. 59-84.

[2]See Waas, George J. Recent Federal Income Tax Changes Affecting Cooperatives. U. S. Farm Credit Administration. Misc. Report 156. Washington, D. C. 1951.

obligation to make patronage refunds exists, the courts of this country have held that they are legally refunds of excessive charges for operating costs included in the tentative settlement, which are returned to the participating firms after actual costs and sales proceeds have been determined. The courts have ruled that they are simply a means of adjusting the members' transactions to actual cost. Since they are not income at the corporate level, they are not subject to federal corporate income taxes. Refunds made to customers when prior contractual obligation exists have been held not to be income to any corporation, cooperative association or otherwise.

The firms participating in a cooperative association pay federal income taxes on all their income including that received from the cooperative association. If these firms are individual proprietorships, the individual entrepreneur pays this income tax at the personal federal income tax rate. If they are partnerships, the partners pay the tax on their respective share of the total net income of the firm at the personal federal income tax rate. If they are corporations, they pay federal income taxes at the corporate rate on their total net income, and their stockholders pay federal income taxes again at the personal rate on any of this income paid out to the stockholders.

So much for the brief description of the present federal

income tax treatment of cooperative associations and the economic units which organize and operate them. It is obvious that the present federal income tax policy with respect to business units is based strictly on the legal nature of these units rather than on their economic nature. The economic nature of the firm is the same whether it is a corporation or a partnership, but it will be taxed differently according to its legal nature. Plants owned and operated by a single parent firm may or may not be incorporated separately; if incorporated separately, the plant is, or can be, a taxable unit for federal income tax purposes; if not it is ordinarily a part of another taxable unit. And since it is incorporated, and even in instances when unincorporated, the joint plant of the cooperative association is a taxable unit for federal income tax purposes.

The tax treatment of patronage refunds is based entirely on the legal definition of what is and what is not constructive income to the cooperative corporation. Legally, patronage refunds, where prior contractual obligation to make them exists, are not constructive income to any corporation so are not taxable to the cooperative as such, or to any corporation using them. Since the present tax treatment is thus based strictly on legal concepts, all that the economist can say to this point is that the legal concept of patronage refunds and their income tax status corresponds to their true economic nature. However the legal logic behind this ruling

does not entirely correspond to the economic logic. The heart of the ruling as to the legal nature of patronage refunds is based on the prior contractual obligation of the cooperative corporation to make them. This is typically backed by the concept of the cooperative association as a legal agent.

> Some Federal decisions have been bottomed up on the theory that by reason of pre-existing contract, the cooperative is merely an agent of the members, and, ergo, can have no income of its own account. All funds coming into the possession of a cooperative, under this theory, are held by the cooperative as agent for its principals, the patrons both members and non-members.[1]

The economic nature of the patronage refund, on the other hand, grows out of the multi-firm plant structure of the cooperative association.[2] The "purchase and sale" method is simply one convenient practical way of operating the joint plant. The "price" at the time goods move from the joint plant to the individual plants of the participating firms, and vice versa, is not an economic price, but only a tentative settlement. Patronage refunds, and they could conceivably be negative as well as positive, are the means by which final settlement is made under this method of operation after the total per unit cost of operating the joint plant and the

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[1] Hensel, Eugene L. Taxation of Cooperatives. In Jensen, A. Ladru et al. Cooperative Corporate Association Law and Accounting; 1950. p. 81-103. American Institute of Cooperation. Washington, D. C. p. 90.

[2] As presented particularly in Chapters III, IV and V above.

proportional net return to each participating firm has been determined. The amount of these patronage refunds at the end of any operating year can be made large or small simply by varying the accounting "price" at the time the goods are transferred between the joint plant and the individual plants of the participating firms.

So long as the incorporated cooperative association is legally a corporation, and so long as taxation policies are based strictly on the type of legal unit, this contribution is all that the concept of the economic nature of the cooperative association can offer toward the understanding and evaluation of the federal income tax treatment of cooperatives. Legally in the interest of consistency it would seem difficult indeed to justify a statute exempting selected corporations, such as exempt farmer cooperatives and certain other corporations, from legally constructive income to the corporation. It would seem equally difficult to justify any statute taxing any legal unit for any income not constructively received by it, such as a statute making patronage refunds taxable to the cooperative corporation would do.[1] The Revenue Act of 1951 has greatly reduced the importance of the exemption of farmer cooperatives and Congress so far has seen fit to pass no legislation counter to the decisions of the courts relative to the taxation of patronage refunds.

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[1] And also as taxing rebates, discounts, etc., to any corporation would do.

However, the present policy of basing taxation strictly on the legal structure of business units without regard to their economic structure is inconsistent and entirely without economic foundation. Such a tax forces some firms to operate inefficiently[1] in their own best economic interest. It creates serious tax "loop holes", and causes inequities as between firms which are of different legal nature and as between business units with the same legal nature but different economic structure.

A much more fair, consistent, and effective federal income tax policy toward business units would be to tax the economic firm which makes and has title to the income at a rate comparable to that of the personal income tax, and exempt from personal income taxes all funds which have previously been taxed to the firm, such as dividends on stock and distributions of partnership and individual proprietorship earnings.[2] Under such a policy the economic firm, regardless of its legal form, would be taxed as a unit. Economic <u>plants</u> operated as part of the parent firm would be taxed only as a part of the parent firm, regardless of the legal form of the plant. Corporate firms would be taxed as they are at present, except that dividends and other allocations to stockholders would be

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[1] I.e., what would be inefficiently in the absence of such a tax policy.

[2] Virtually the same results could be achieved by eliminating the income tax on business units entirely, and collecting

exempt from taxation again in the hands of the stockholder. Partnership and individual proprietorship firms would also be taxed in this manner, and any allocations to the partners or to the proprietor would be exempt from taxation again in their hands. No economic plant, corporate or otherwise, would be taxed as such. The income produced in the plant represents an addition to the income of the firm, and would be taxed to the firm. It cannot be computed accurately any other way.

It is impossible to determine any actual profit or loss, as distinguished from a purely accounting "profit" or "loss", in any single plant of an integrated firm because goods and resources moving from one plant to another neither enter the market nor change hands and no price is established for them. The entrepreneur of an integrated firm does not seek to maximize profits in any one plant; indeed, when goods and resources are transferred between plants in the total operation of the firm, he cannot. Instead he seeks to operate all of his plants in such a way as to maximize antitipated profits to the integrated firm as a whole. It is economic nonsense, therefore, to attempt to levy an income tax on a plant as such. The apparent income of the plant may be high or low depending upon the accounting "prices" used for commodities and resources transferred into and out of the plant by the entrepreneur of

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all income taxes on personal income. Unallocated reserves and surplus, etc., are the biggest practical problem with such a system.

the parent firm.[1]

Exactly the same is true of the jointly operated plant of the cooperative association. Since the plant is jointly operated by the participating entrepreneurs as an integrated part of each of their firms, any income made by the operation of the joint plant is reflected as additions to the income of the participating firms. Although incorporation fails to reflect adequately the economic structure in the cooperative association, the fact that the association is legally made a croporation under existing laws in no way modifies its basic economic nature. Not only does the apparent income in the joint plant depend upon the bookkeeping "prices" for goods and resources transferred to or from the joint plant by the participating entrepreneurs from or to their individual plants, but also upon the method of operation used in the joint plant. When the joint plant is operated on a cost basis currently, either by assessing costs to the participating firms as they occur or are anticipated, or by a pooling operation where actual costs are taken account of before settlement is made with each participating entrepreneur, little or no apparent income is accumulated in the joint plant. When the joint plant is operated on a purchase and sale basis so that

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[1]This analysis applies only to actual subsidiary plants, and not to interlocking directorates, interlocking stock ownerships, etc., where certain contractual arrangements exist, but the separate units each pursue their own economic career.

final settlement is made with the participating firms after actual costs or proceeds for the operating year have been determined, the apparent income from the joint plant may be substantial. Actually there is no reason why the real contribution of the joint plant to the net income of the participating firms should be different simply because of a particular method of operation in the joint plant.

The only realistic way to levy an income tax on the income produced in the joint plant of the cooperative association from the standpoint of economic structure is to tax each participating firm on its entire net income, including its proportionate share of any current income not allocated to the participating entrepreneurs as such but retained in the joint activity as additional equity capital. Regardless of the source of income from the joint plant--capital gains, non-member business, incidental income, government business, or the actual production integrated with separate plants of the participating firms, and regardless of how this income accrues to the participating firms--dividends on stock, unallocated earnings, allocated earnings retained in the joint activity, cash allocations of earnings, or added income in their individual plants, which from an accounting standpoint is not attributable to the joint activity at all, the tax would be levied directly to the participating firms of which the joint plant is a part. Thus if federal income tax laws were based on economic units rather than on legal units,

comparable business income taxes would be levied on all firms regardless of their legal nature. However, plants would not be taxed as such. Instead the income produced in plants would be taxed as a part of the income of the firm or firms to which the plants belong. The tax status of participating firms in a cooperative association would be very much like that of partners in a partnership at present, except that it would be participating firms which are taxed rather than participating individuals as in the partnership now. Under such a policy the partnership would be taxed the same as any other firm, which would be very much like the corporation is now taxed, except that allocations of income to the individual owners of the firm would not be taxed again to the individuals.

The present income taxation of business units in the United States is based entirely on the legal nature of these business units rather than on their economic nature. Since legally the cooperative is ordinarily a corporation, it is taxed like a corporation, except for certain qualified farmer cooperatives, which are made eligible for exemption from corporate income taxes except on earnings which are not allocated to the participating firms. The cooperative association which makes prior contractual arrangements to make patronage refunds does not pay corporate income tax on these refunds when allocated to its patrons. The present tax treatment of cooperative associations as well as other

corporation, partnerships and other business units reflects the legal but not the economic nature of these different business units.

Not only is incorporation itself inconsistent with the economic nature of the cooperative association, but the taxation of all similar legal units in the same manner without regard to their economic nature, and the taxation of different legal units differently even though their economic nature is the same, cause further difficulties. The economic firm is the basic economic unit in which production decisions are made, and the net income if any made in this production process accrues to the firm and its entrepreneur. The economic plant is not a basic economic unit of production in this sense, but only a part of some firm. The joint plant of the cooperative association is a part of each participating firm. The basic economic nature of either the firm or the plant is neither determined nor changed by its legal nature. If the income produced by business units is to be taxed to those units, the economically rational way to do so is to tax the basic production unit, the firm, and to tax it in a consistent manner regardless of its legal nature. The economic plant should be taxed only as a part of its parent firm or firms. The plant owned and operated jointly by a group of cooperating firms is no different in its economic nature than a plant owned and operated by a single firm.

B. Business with Non-Participating Firms

An often discussed issue is the advisability and even the possibility of "non-member business" in a true cooperative association.[1] A related question is the economic treatment of non-members who do business with the cooperative association. According to Emelianoff, ". . .business transacted with outsiders is the basic factor of the degeneration of cooperative aggregates through pseudo-cooperative forms into collective enterprises."[2] Some have argued that non-member business as such does not reflect a weakness of cooperative character, but that non-members should be treated as members. This provision is one of the requirements for exemption from federal income taxes under Section 101(12) of the Federal Internal Revenue Code.[3] Others argue that non-members assume no entrepreneurial responsibility for the joint plant and therefore are not entitled to comparable treatment. The present cooperative association enabling act in Iowa makes no provision for payment of patronage refunds to non-members except those who have subscribed to membership.[4]

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[1] "Non-member business" in the joint plant is used to mean the purchase of inputs from or the sale of outputs to non-participating firms in addition to these same inputs obtained from or outputs furnished to the participating firms.

[2] Emelianoff. op. cit., p. 230.

[3] Cf. Davis. op. cit., p. 66-68.

[4] Iowa Code. 1946. 1:499.30.

However, like that of most other states, the Iowa statute permits non-member business up to an amount equal to member business. Dr. Nourse is among those who have criticized such a policy. Commenting on the Capper-Volstead Act, he has stated in regard to this point,

> But such associations are permitted to deal in the products of non-members to an amount equal to those handled for members. This provision weakens materially the non-profit character of associations formed under the law,. . .
> . . .it would seem that permitting them [cooperatives] to deal upon such terms as they might see fit in the product of outsiders reduces them to the level of a profit sharing form of organization.[1]

Business with non-members to a reasonable extent continues to be a common practice in cooperative associations, however. In many cases non-members are nottreated as members and corporate income taxes are paid by the association on earnings from non-members. Non-member business is apparently a confusing issue and a point where there is wide divergence between the opinions of many cooperative economists and what is actually done in practice in cooperative associations. Dr. Nourse concluded in the same connection as that of the above quotation from him,

> As a matter of practical expediency, it does appear to be important that cooperative associations should not be prevented from handling the product of non-members under any and all circumstances. . . . It is the opinion of the writer that the situation could have been better met by the placing of a limit of something like 10, 15, or even 20 per cent upon

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[1]Nourse. Legal Status. . . . p. 255-256.

business which might be done for non-members.[1]

Is there anything in the basic economic nature of the cooperative association which is counter to the outside purchase of products for the joint plant in addition to those supplied to it by the individual plants of the participating firms? Or alternately is there anything which is counter to the outside sale of products from the joint plant in addition to those supplied to the individual plants of the participating firms. It would seem that if such practice increases the anticipated profits and/or stability of profits to the participating firms there is no inconsistency. But if such practice is motivated by a desire to make the joint plant as such more profitable, without regard to the effect on the participating firms, the practice is inconsistent with the economic nature of the cooperative association.

When the shapecthe long run average cost function in the joint purchasing plant is such that per unit costs may be reduced by adding additional volume, the participating firms are likely not in production equilibrium. The costs of operating the joint activity may be reduced to each of them by increasing the size of the joint plant. In those cases where operating efficiency may be increased by adding volume in the joint plant, the member firms will gain this efficiency most economically by inducing additional firms to participate.

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[1] Ibid., p. 255-256.

This is true because the added participating firms will allocate resources to the joint activity, so that the added efficiency comes without additional outlay as far as the previous group of participating firms is concerned. Ordinafily, therefore, expansion in the joint plant will take place in this way. Typically, however, the output of the joint purchasing plant operating at an efficient volume may include some "surplus" not needed in the individual plants of the participating firms. Such surplus is disposed of by sale to non-members--firms to which it is currently uneconomic, because of conflicting objectives, the temporary nature of their demand for this product, inability to bear the uncertainties of the joint activity, more productive opportunities for their resources, and similar reasons, to participate in the joint plant. This sort of non-member business is economic to the participating firms, and is consistent with the economic nature of the cooperative association. It will enable the participating firms to increase operating efficiency in each of their firms, and thereby make the operations of these firms as such more profitable. Ordinarily such non-member business will represent a small percentage of the total volume in the joint purchasing plant.

The case is parallel when the participating firms jointly operate a marketing plant except that, as shown in chapter 8, the optimum plant size is defined by equating the slope of the long run average cost curve (which is net of raw

product input costs) with the slope of the long run average revenue curve. If this average net return to each participating firm from the joint plant can be increased by a larger size in the joint plant, these firms are likely not to be in production equilibrium. Beyond the point where it is possible to secure additional firms for participation in the joint activity, the participating firms may achieve the optimum size in the joint plant by purchasing the "deficit" raw product input from non-participating firms--firms, which, because of their own position, find it uneconomic to participate in the joint activity. If the supply curve for these raw products is such that it is economic to expand under these conditions, it is not only consistent to transact a limited amount of non-member business in the joint marketing activity, but necessary to do so in order to achieve production equilibrium in each participating firm.

What about the status of the firm that transacts business with the joint activity, but finds it economic not to participate in the joint activity? On the basis of the multi-firm plant concept, the status of such a firm is strictly that of outsider. The production activities of the non-participating firm is in no way integrated with the joint activity. Such firms have entered into none of the multi-lateral economic relationships which exist among the participating firms. They have no obligation--legal, moral, or otherwise--to the joint activity or to the participating firms individually.

The entrepreneur of the non-participating firm allocates his resources and makes his production plans only on the basis of the independent and separate activities of his firm. The products purchased at the joint plant and those sold there by the non-participating firms are traded at a true economic price. Economic title changes and, in the absence of misrepresentation, the transaction is, or should be, final and binding to both parties. Non-member firms do not transact business through the joint plant as do the participating firms. Instead they transact business with the joint activity, or actually with the participating firms as a group. Economically they cannot be treated like member firms, but must be treated strictly as outsiders. From the point of view of the economic nature of the cooperative association, the relationship of non-members to joint activity, and to the participating firms which comprise it, is the same as that of the firms or households purchasing the output of the joint marketing plant or supplying inputs to the joint purchasing plant. When non-members do business with the cooperative association they are partners to an economic transaction and nothing more.

When non-member business is transacted in order to reduce per unit costs in the joint activity and thereby make the several firms of the participating entrepreneurs more efficient, such action is consistent with the joint plant concept and the objectives of the participating firms. In such case, the non-member firms should be treated strictly as third

parties. However, non-member business can be a definite symptom of the degeneration of the true economic character of the cooperative association. If the non-member business is motivated by anticipated profits in the joint plant as such from this business without regard to the effect of the non-member business on the efficiency of the participating firms, the economic nature and purpose of the cooperative association has been disregarded. Increases in non-member business under such circumstances represent true degeneration of the economic character of the cooperative association. The joint activity gradually ceases to be an integrated part of the total activities of the participating firms, and pursues more and more an independent economic career. The resulting structure is a jointly owned economic firm which buys from and sells to the member firms as well as non-member firms for a price which will maximize its profits. This jointly owned firm is likely to share its profits with the former participating firms which continue to patronize it. And the more the jointly owned firm can gain by monopoly or monopsony exploitation of these patronizing firms, the greater the profits it will have to share with them.

It is not the non-member business, per se, that causes the degeneration. If the joint plant remains an integrated part of the participating firms, and it is controlled and operated by the participating entrepreneurs in the best economic interest of each, considering the total integrated

production in the participating firms, degeneration will not take place. When non-member business is carried out only to the extent that it is motivated by the opportunity to increase the operating efficiency of the participating firms and represents optimum resource allocation within these firms, it is consistent with the basic economic nature and purpose of the cooperative association.

C. Maintaining Control

The problem of maintaining adequate control of the cooperative association in the hands of the participating entrepreneur is one of substantial practical importance. Always something of a problem, even in the local association covering a limited geographic area, it becomes much more crucial in large and regional associations of both the federated and centralized type. Ordinarily the enabling statutes for cooperative associations contain both negative and positive provisions which insure fairly adequate machinery for control of the joint plant by the participating entrepreneurs.[1] Primarily the problem is inadequate utilization of the machinery which is available.

The concept of the basic nature of the cooperative association has little to offer in regard to making more

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[1] This machinery for adequate member firm control over the joint activity is not universally satisfactory, however.

effective use of this machinery. To a large extent the solution to this problem lies outside the field of the economist. Such disciplines as political science, sociology and even psychology can and must offer the basic solution to it. The basic nature of the cooperative association explains why the problem exists, however, and why it is of such importance.

The minority common stockholder in a corporate firm neither worries nor needs to worry much about an effective voice in the control of the corporation. Since the corporate firm pursues an independent economic career, policy makers are concerned only about the economic operations of the firm as such. In general, as long as the majority stockholder acts rationally in his own best interests, he will act in the best interest of the minority stockholder as well. The income of both will be at a maximum when the corporate firm produces at the best production combination and at the output which maximizes profits to the firm. The opinion of the small stockholder may differ with that of the control stockholder as to reserve policy, executives' salaries, and so on, but in general he is willing, and wisely so, to be guided without question by the more experienced and capable entrepreneurial decisions of the majority stockholder. Salaried management is also interested in maximizing profits to the corporate firm as such, not only because managerial personnel are typically stockholders, but also because their value to the corporate firm as a salaried employee is maximized when they

act in the best interests of the firm as such, and therefore in the interests of the minority stockholder. The problem of the separation of control from risk bearing in the corporate firm is of little concern to the small stockholder because his best interests tend to be autometically protected anyway.

The picture in case of the cooperative association is entirely different. The joint plant is controlled not by a single collective entrepreneur as is the corporate firm, but by the several individual associated entrepreneurs. All entrepreneurial decisions relating to the joint plant must be made considering the entire production operations of each participating entrepreneur. Unless the individual operations of each participating entrepreneur are unrealistically assumed to be identical, there are real possibilities of conflict of objectives within the group of entrepreneurial decision making units for the joint plant. The economic nature of the cooperative association makes it important that all of the participating entrepreneurs be informed as to the effects of policy decisions regarding the joint plant and that they have and exercise an active voice in the determination of these decisions. As contrasted to the corporate firm with its joint entrepreneurship, the cooperative association, by its nature, cannot be controlled exclusively by a small "inside" group without the risk of misallocation of resources and economic inefficiencies in the majority of the participating

firms.

The participating entrepreneur who refuses to become involved in the decisions concerning the joint activity is acting irrationally in his entrepreneurial role. His proportionate share of the joint plant is as much a part of the economic firm under his entrepreneurship as is his individual plant, and his decisions in each must be made considering the two as an integrated production unit. While he can count on the small group of participating entrepreneurs who act rationally in the best interest of their own firms to make many decisions in the joint plant consistent with the interest of his firm, e.g., efficiency within the joint plant given the activities conducted there, there are other decisions which he cannot count on them to make in his best interest. Such things as expansion by further vertical integration, addition of specific new departments in the joint plant, increases in the owned equity in the joint activity, or contractions in any of these are likely to affect some of the participating firms differently than others.

It is important, therefore, that such entrepreneurial policy decisions with respect to the joint activity <u>not</u> be made by the board of directors or some other small group, but by the majority of the participating entrepreneurs at an annual or special meeting. The participating entrepreneurs should have all relevant information before making the decision. The quorum for such meetings should certainly be more than a

handful of the participating entrepreneurs, and the decisions should not be made hastily, but only after due study and discussion. Referendum machinery should also be provided and used whenever there is any question as to majority endorsement of a given decision made by the board of directors. Decisions which, by their nature, would be made in a like manner in the best interests of all participating entrepreneurs are more effectively made by the board of directors than by the several participating entrepreneurs as a group.

Getting adequate participation in entrepreneurial control by the majority of participating entrepreneurs is frequently a serious practical problem. An understanding of the basic economic nature of the cooperative association by the participants will reduce the magnitude of this problem. An adequate understanding by each of the issue to be decided and the effects of the decision on their total production activities will help also. A constructive attitude, based on adequate information on the part of the board of directors and management, which will motivate them to refer important issues and all information relevant to these issues to the membership, is highly important. And not to be forgotten is the careful selection of new participating firms, both from the standpoint of their continuity of interest and of their willingness to share jointly the decisions of the joint plant.

D. Expansion Programs

Although the percentage of total business in the United States conducted through cooperative associations has remained relatively unchanged over the past two decades or more, in some individual associations expansion has been rapid and pronounced. This is particularly true of some of the cooperative federations and other regional associations. While this expansion probably has been sound, in most cases at least, it has not been without its "growing pains". The expansion has meant that the participating entrepreneurs have had to allocate considerably more capital to their joint activity in most instances. Some individual cooperative members have, on occasion, been critical of these expansion programs because of this increased demand for their capital in the joint activity associated with the expansion.

One reason for this criticism is the fact that these cooperative members have not had the opportunity, or if they have had the opportunity they have not availed themselves of it, to participate adequately in making the decision to expand. This is a part of the problem of maintaining adequate participation in the decisions relative to the joint activity discussed above. But the expansion problem also stems in part from a lack of understanding of the basic economic nature of the cooperative association. There are two factors in the picture in this regard. First of all when the

expansion program in the joint plant represents rational economic behavior to the participating firms, it is apparent that the marginal productivity of the capital tied up in the expansion justifies the additional allocation of capital to the joint activity. To be rational, the expansion of the joint plant must represent the best alternative use of capital in the participating firms considering the total production operations of each participating entrepreneur. If this is the case, the member firms should not begrudge the expansion program, but welcome it as the best alternative use of the resources within each firm. The expansion program will enable them to increase their anticipated profits, or the anticipated stability of these profits, and move to a higher stability-efficiency indifference curve (see Figure 9). Even though each participating entrepreneur finds that the expansion program in the joint activity pulls some of the limited capital resources available to him away from his individual plant, the expansion is rational if the economic position of the participating firm is improved by such a move.

On the other hand not all the apparent earnings from the joint activity should necessarily be invested in the production activities in the joint plant. They may have better alternative uses elsewhere within the participating firms. The rate at which dollars of patronage refunds can be accumulated and deferred, for example, is not a sound basis for determining an expansion policy in the cooperative

association. Such a plan may result in overexpansion or it may result in an underexpansion of the joint activity, depending upon the marginal productivity of capital in this use compared to alternative uses in the participating firms. Of course, as has been seen, the amount of patronage refund available to the participating entrepreneurs depends on the accounting "price" at time goods are transferred between the joint plant and the individual plants of the participating firms, so that considered alone the patronage refund is no measure of the economic efficiency of the joint plant. But beyond this, no one department in any firm has special claim to actual profits for the firm made by that department. The entrepreneur disposes of the profits according to his expectations and indifferences. If profits are invested in the firm, the entrepreneur will direct this newly earned capital into the anticipated most productive use within the firm. This will not necessarily be to the department which earned the capital.

Expansion of the joint activity out of the apparent earnings to the participating firms, with the rate of expansion determined by the amount of these apparent earnings, as, for example, financing joint plant expansion with deferred patronage refunds, will represent economically rational behavior only by accident. Because all alternative uses for capital within the participating firms must be considered, such a policy is not comparable to the reinvestment of profits

in a corporate firm. All additional capital invested in their firms by the participating entrepreneurs should be used in the most productive alternative as defined by the effect of each alternative on the efficiency and stability of the total integrated operations of the firms. In a given situation this may mean either vertical expansion or the addition of new departments in the joint plant, or alternatively it may mean expansion of the production activities carried on in the individual plants of the participating firms. Exactly the same is true where the expansion is financed by borrowed capital rather than participating entrepreneur equity capital.

E. Financing the Joint Plant

The problem of securing adequate financing for the joint plant and of maintaining the distribution of the financial responsibility on an equitable basis among the participating firms always seems to be a problem, or at least a potential one, in cooperative associations. Currently, with the growth of regional cooperative federations, the decreased purchasing power of money capital for fixed and working facilities, and indifference and lack of understanding of some members regarding their joint activity, the problem is magnified. Both the financial problems and their solution seem to vary from association to association. It is hard to find two cooperative associations with financial structures exactly alike. There

apparently is no one best method or combination of methods of financing the joint activity under all circumstances. Frequently custom, and the understanding of the participating entrepreneurs, rather than the consistency of the financial plan with the economic nature of the cooperative association, determine the plan in use.

The financial responsibility of the participating entrepreneurs for the joint activity, and the application of the proportionality concept to the sharing of this responsibility has been discussed, particularly in chapters 5, 6, and 11. It was seen that the participating firms will share the actual allocation of capital on a proportional basis only when the marginal productivity of capital is assumed to be equal among all participating firms. It was also pointed out that, assuming fixed quantities of equity capital in each firm, the participating entrepreneurs as a group will provide all of the capital for the joint activity only when they are unable to obtain the use of capital in the market for less than its anticipated marginal productivity to them in their joint plant. The case where member firms have one hundred percent equity in the joint plant, and share this equity among themselves on a proportional basis, is desirable only under special conditions. It certainly is not an ideal or goal to be strived for in all cooperative associations, as is quite frequently believed in practice.

All direct allocations of capital to the joint plant as

a required condition of participation should be on a proportional basis, however, rather than on a per firm basis. In most local cooperative associations, such required allocation of capital is either in the form of a membership fee or a share of common stock, both of which are ordinarily on a per firm basis rather than on a basis proportional to participation in the joint activity. The par value of such common stock or membership fee is so small ordinarily, however, that the disproportionalities against the smaller participating firms are negligible. In such cases, the problem is that such allocations fail to provide a sufficient amount of equity capital for the joint plant. Where the par value of these certificates of membership is high enough to provide sufficient capital, the disportionalities among the participating firms become serious. The only solution, it would seem, is to base such allocations on percentage participation; otherwise the result will be some compromise between two important problems--insufficient capital allocations to the joint activity in this manner, and disproportionalities among the participating firms.

Where the marginal productivity of capital differs considerably among the participating firms, as it does with firms engaged in agricultural production,[1] for example, it is important that each participating firm be provided the

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[1] Largely because of the normal life cycle of the family farm firm.

alternative of subscribing this required capital allocation to the joint activity and allocate a part of it by a series of periodic installments, either from his apparent earnings from the joint plant or from some other source. The firm choosing this alternative should be required to pay a fair rate of interest on his unpaid subscription, and can well afford to do so when the marginal productivity of capital in the firm is high. Firms in which the marginal productivity of capital is lower than this interest rate will choose to make their entire required capital allocation directly rather than in periodic installments.

When differences in the marginal productivity of capital between firms exist, it is important also that participating entrepreneurs have the opportunity to invest additional capital in the joint activity and that they be induced to do so by an attractive rate of interest on such an investment. The interest on such capital becomes an explicit production cost in the joint plant. The actual effect is that participating firms in which the marginal productivity of capital is high borrow capital from participating firms in which the marginal productivity of capital is low. An interest rate on this capital somewhere between the marginal productivities of capital in the two groups of firms will improve the economic position of the firms in both groups. As a practical matter, from the standpoint of financial security in the associated activity, it is well to have such investments well

distributed among the participating firms, so that withdrawal of the investment capital by any one firm will not jeopardize the position of the joint plant. This policy also insures that the interests of each participating entrepreneur as an investor are secondary to his interests as a participant in the joint plant as an integrated part of the total production activities of his firm.

Even when provision is made for additional investments in the joint activity by interested participating entrepreneurs, it is usually economic for the group to borrow additional capital from outside sources. This will be true whenever capital can be borrowed on terms which make its cost less than the anticipated marginal productivity of the capital to the group of participating firms as a whole. Capital needed seasonally in the joint plant such as that needed to finance inventories, can probably be obtained most economically on short term loan from individuals, commercial banks, banks for cooperatives, or elsewhere, depending upon which source will loan on the most favorable terms. Long term loans from similar sources are usually more suited to other capital needs in the joint activity. In addition to loan capital of this kind, the participating entrepreneurs as a group may find it to their advantage to borrow capital by selling "bond-type" securities to the general investing public. Such securities should represent strictly loan capital, and should carry no participation provisions of any kind.

Participating firms often allocate equity capital to the joint activity through a revolving capital plan. The revolving fund most commonly consists of deferred patronage refunds, but revolving patronage deductions are also frequently used, particularly by marketing cooperatives. Both plans are discussed in chapter 6. There is much to be said in favor of the use of the revolving fund by the participating firms to finance their joint plant. It provides a convenient practical means of maintaining proportionality in the allocation of capital for the jointly conducted production activity not only in each operating year, but over time as well. There is nothing about the revolving fund which is basically inconsistent with the economic nature of the cooperative association. Practical problems however have grown out of its use, particularly when it is depended upon for virtually all of the participating firm equity in the joint activity.

Because of the differences in the marginal productivity of capital in the participating firms, the revolving fund, and the resulting strict proportionality in actually providing the capital for the joint activity, as distinguished from sharing the financial responsibilities on a proportional basis, creates inequities and inefficiencies within the participating firms. Also the revolving fund when overemployed is too automatic and may divert member firm capital into the joint activity which, for the group as a whole, would be more productive in alternative uses within the

participating firms. Or alternatively it may provide insufficient capital in terms of its marginal productivity in the joint plant. When used in combination with other methods of allocating capital to the joint plant so that the revolving period is kept reasonably short and the differences in the marginal productivity of capital among the participating firms is taken account of, the revolving fund can be very useful, however.

The use of unallocated reserves created out of apparent earnings in the joint plant as a means of providing capital for the joint activity is in general unsatisfactory and inconsistent with the economic nature of the cooperative association. This procedure, where used, is copied from the corporate firm surplus and other general reserves, which are typically, and with sound economic foundation, used by the stockholders to provide additional capital in the corporate firm. Such a procedure in the cooperative association completely ignores the fact that the joint activity is integrated with the individual production activities of the participating firms. From the point of view of production equilibrium in the participating firms, it may result in either overexpansion or underexpansion of the joint activity, and will correspond to optimum resource allocation in the member firms only by accident. Aside from a limited reserve created to give the joint plant economic stability over time,

free surplus and unallocated reserves have no place in the financial structure of the cooperative association.

Because of capital rationing and differences in the marginal productivity of capital among the participating firms, the most efficient and equitable financial structure in any given cooperative association will be some balance between the following: required ownership certificates, similar to common stock or membership fees but shared on a proportional rather than an equal basis; participant investment certificates, similar to preferred stock or certificates of indebtedness except that they would be held by participating entrepreneurs only; and deferred patronage deductions or deferred patronage refunds. In addition to the equity of the member firms in the joint activity, some capital will probably be borrowed from the general investing public by issuing non-participating "bond-type" securities, and from lenders in the capital market as ordinary business loans. The optimum balance between these several methods of finance in the cooperative association will undoubtedly vary from one association to another, and in a given association over time, as conditions change.

XIII. SUMMARY

Although the cooperative association is an economic institution through which economic activity is conducted in the pursuit of economic objectives, the economist has concerned himself but little with its basic economic nature. The voluminous literature relating to cooperative activity is dominated by the socio-reformistic interpretations and with historical and descriptive information. The so-called basic "principles of cooperation" are referred to frequently and with considerable ardor. Seldom is their significance seriously questioned. General economists, on the other hand, have seldom addressed themselves specifically to the cooperative association. Where cooperatives are mentioned at all they have been looked on simply as a special kind of corporation, covered quite adequately by the general theory of the firm.[1]

The most outstanding work relative to the economic nature of the cooperative association is Emelianoff's "Economic Theory of Cooperation."[2] His principal contribution is the development of the theoretical concept of the economic structure of the cooperative. He disproves the theory that cooperative is a special kind of economic firm, and concludes instead,

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[1] Cf. Boulding. op. cit., p. 444-445.

[2] Emelianoff. op. cit.

> . . .the cooperative association represents the associated economic units in their functioning and not their association as a separate economic entity; an association or aggregate is functioning only as a branch or part of associated economic units; in that respect it is perfectly identical with the special departments or branches of single economic units.[1]

Professor Robotka has also been a leading contributor to development of the theoretical concept of the economic nature of the cooperative association. Of Robotka's published contributions, which unfortunately do not reveal the full extent of his influence, two articles are foremost. These are "Lego-Economic Implications of Cooperation"[2] and "A Theory of Cooperation".[3] Robotka has pointed out the importance of the fact that the economic activities of the cooperative are integrated with the individual activities of the participants:

> Every true cooperative represents an effort on the part of two or more autonomous units jointly to conduct, coordinately with each other, given operations essential to the economic activity of member units. It is the avowed purpose of true cooperators not to impose a business enterprise in the usual sense between themselves and the market. In a technical economic sense, this can only mean that it is their purpose to function in their own capacities as sovereign units, that is, to perform designated functions or services as integrated with their individual economic pursuits.[4]

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[1] Ibid., p. 249.

[2] Robotka. Lego-Economic. . . .

[3] Robotka. A Theory. . . .

[4] Robotka. Lego-Economic. . . . p. 526.

Robotka has also contributed substantially toward the clarification of the economic nature of the multi-lateral relationships existing among the participating units in a cooperative, and has pointed out that, "The cooperative organization consists of the sum of the relationships and arrangements established among member units in order to effectuate their purpose."[1]

Werner Hirsch has made a substantial contribution toward defining the conditions of optimum output and price determination under which a vertically integrated firm, such as one participating in a cooperative association, will maximize its profits under static conditions. Hirsch summarized his analysis by saying:

> Regardless of the number of levels to be integrated, we found that this would be achieved at a volume (Q) which would equate the marginal revenue of the level closest to the ultimate consumer with the marginal cost of the level farthest removed from him. The price would be determined at this output on the corresponding demand function. Yet we found also that we would have to adjust the marginal cost function which is farthest removed from the consumer if handling charges were payable to outsiders and/or were functionally related to the volume handled.[2]

By building on the contributions of these men, and on the contemporary economic theory of the firm, the attempt here has been to develop a realistic, workable, and reasonably complete

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[1] Ibid.

[2] Hirsch. op. cit., p. 101.

theory of the economic nature of the cooperative association. This theoretical framework involves the economic structure of the cooperative association, the economic relationships among the participating units, and the conditions necessary for rational economic behavior in the cooperating firms.

A. The Jointly Operated Plant

When a group of individual firms form a cooperative association they simply agree mutually to set up a plant and jointly operate it as an integral part of each of their individual firms (or households in the case of a consumer cooperative).[1] The cooperative has no more economic life or purpose apart from that of its parent member firms[2] than one of the individual plants of a large multi-plant firm. It is technically correct to speak of the cooperative plant and of cooperating firms, but not of the cooperative firm.

As an economic institution, the cooperative association is not an organization of persons, either as laborers, as capital contributors, or as patrons, for that matter. It is an organization, as Emelianoff and Robotka both point out, of sovereign economic units--firms or households.[3] Saying

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[1]Cf. Nourse. Legal Status. . . . p. 171, and Robotka. Lego-Economic. . . . p. 526-527.

[2]The term "firm" used here and elsewhere will be understood to mean firm or household, since structurally cooperatives of firms and cooperatives of households are identical.

[3]Emelianoff. op. cit., p. 249, and Robotka. Lego-

that a cooperative association is a business organization owned and controlled by its patrons and operated for their benefit as patrons, while descriptively correct, contributes nothing to the understanding of the economic structure of the cooperative. Patronage, unlike capital or labor, is not a productive resource capable of earning an economic return in the production of goods and services. It is not possible "to organize an economic system from the standpoint and for the benefit of the. . .patrons"[1] as the controller of a given factor of production, but it is possible for firms jointly to organize and operate a common plant with the idea of maximizing the economic returns to each of the individual associated firms.

The entrepreneurs of the associated firms each must allocate productive resources to their common plant, however, the same as a multi-plant firm must allocate resources to each of its plants. From the standpoint of resource allocation, the associated firms in a cooperative cannot be in static partial equilibrium (under the profit maximization assumption) unless resources are allocated to the joint plant to the point where the marginal productivity of each resource in the cooperative plant is equal to the marginal productivity of that resource in the individual plants of

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Economic. . . . p. 526

[1]Nourse. Legal Status. . . . p. 21.

each of the member firms, and the marginal productivity of the last dollar is equal in every use within each firm.

The cooperative activity is an economic plant operated jointly as a part of several firms. The cooperative association consists of the sum of the multi-lateral agreements among the firms participating, in order that these firms may function coordinately through their common plant. The cooperative as such has no entrepreneurial unit; its member units each have their entrepreneur. Although each retains its individual sovereignty, all member firms are more than "aggregated"[1] with respect to their joint plant--they are associated by multi-lateral agreement in a rather definite manner. They are not merged however. Except for their joint operation of the cooperative plant, they are unassociated and uncoordinated, functioning entirely independently of one another.

With respect to the coordinated economic activity, each participating entrepreneur must sacrifice some of his "rugged individualism" and agree to become one member of an economic team. He must submit to team decision, as determined by the majority of the individual members of the team, even though these decisions may sometimes conflict with his individual interests.[2] He must submit to pooled uncertainties and pooled

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[1] See Emelianoff. op. cit.

[2] His firm will withdraw from participation in the joint activity if this conflict causes participation to be less economic than his best alternative.

costs, regardless of his own position. If the individual interests of the participating firms differ very much, their operation of a plant jointly will be uneconomic, because the economies of scale in the plant will be more than offset by individual differences among the firms. The cooperative firms, however, sacrifice no sovereignty whatsoever with respect to their individual operations outside the joint plant. The individual entrepreneurs carry complete responsibility and function entirely apart from the others with respect to such operations, considering the total operations of each of their integrated firms as an economic unit. The cooperating entrepreneurs as a team have no influence over the activities of the individual participating firms outside the joint plant.

B. Relationships among Participating Firms

Emelianoff has adequately written, "All economic relationships of members within their aggregate are based on the irrevocable principle of proportionality of their economic participation in activities of the aggregate [cooperative]."[1] These economic relationships among member firms arising from their joint operation of a common plant have to do with (1) the use made of the plant, (2) the decision making regarding

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[1] Emelianoff. op. cit., p. 223.

the plant and its operations, (3) the financial responsibility for the plant, (4) the fixed and variable costs of operating their plant, (5) the uncertainties in connection with the plant and its operations, and (6) the economic benefits (positive or negative) which occur from operating this joint plant.

The cooperating firms are faced with two questions concerning each of these relationships: (1) what specific group is responsible for each? and (2) how are they to be shared among members of the group? The responsible group is obviously the sum of the entrepreneurs of the individual firms that are operating the plant jointly. No other group can be expected to use the plant, to exercise control over it, to assume the financial responsibility for it, to bear the costs in connection with it, to shoulder the consequences arising from uncertainties in connection with it, or to partake of the economic benefits of the joint plant.

The only equitable way the entrepreneurs of the individual cooperating firms can share in these economic relationships is on a proportional basis--a basis proportional to the use which the size of each firm dictates its entrepreneur will make of the joint plant.[1] This is the only way which

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[1] Where the joint plant performs a limited function (e.g., churning and marketing butter) the size of the parent firms which determine the percentage of use each entrepreneur will make of the plant will only be that part in each firm related directly to functions of the plant (e.g., pounds of butterfat produced and supplied to the joint plant).

will be mutually satisfactory to all participating entrepreneurs, because a misallocation of productive resources among cooperating firms will result from sharing them on any other basis. The methods of sharing all the other economic relationships among the cooperating firms is therefore specified according to the proportionate use (patronage) of the joint plant made by each.

In a one department cooperative for a given operating period, the proportionate use made of the cooperative by the entrepreneur of each participating firm will, in other words, determine the way they will share the control (voting), the uncertainty bearing, the costs, the financial responsibility, and the economic benefits incident to or arising from the joint plant. Therefore, from the standpoint of economic structure, voting in the cooperative association will not be done on a per firm (one-man one-vote) basis but on a use (patronage) basis; all costs including costs of risks will be shared on a use basis; the uncertainty bearing will not be shared on a per firm basis but on a use basis; financial responsibility (i.e., either providing the actual capital or paying the interest and providing the security required to obtain it) will be shared on a use basis; and the economic benefits, if any, will be shared on a use basis.

Given perfect knowledge and certainty, the rule of proportionality in the sharing of the economic relationships among the cooperating firms also applies over time and

between departments. Under these assumptions, the firms jointly operating each department will participate in all economic relationships proportional to their use of that department. Furthermore all relationships arising from the operation of the joint plant that are common to several departments will be shared by the groups of firms participating in each of the departments concerned on a basis proportional to the fraction of total operation of the joint plant represented by each of their departments. Costs, uncertainties, financial responsibilities, and decisions specific to a given department will be of concern only to the firms jointly operating that department.

What about the interfirm relationships over time which arise from their participation in the joint activity? A given proportional sharing of the joint plant (such as that shown in Figure 1) for one operating period will not necessarily hold for other time periods. Proportionality must therefore be maintained between the groups of participating firms in each operating period as well as within each such group. All relationships which extend over time will be shared among the groups of firms operating the joint plant in each period on a basis proportional to the relative size of the plant in each period.[1] Relationships which are

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[1]Provided the relationships affect each operating period on a basis proportional to the size of the plant operation in each period.

specific to a given operating period will be participated in only by the group of firms sharing in the joint activity during this period. Intertemporal and interdepartmental relationships are shared by the groups of participating firms involved. They share these relationships proportionately, both within and between the participating groups. Relationships specific as to time and department will be shared only by the group of participating firms concerned.

Under conditions of uncertainty and imperfect knowledge, proportionality is also the basis upon which the firms participating in a joint plant share the multi-lateral economic relationships, including those which are interdepartmental and intertemporal. However, it is planned proportionality rather than actual realized proportionality that guides the participating firms under these conditions. It may also be economic to pool relationships which are specific to a given department or time period in order to reduce the expected dispersion around the most probable anticipated values of relevant variables facing each participating entrepreneur. How far they will go in this direction depends upon the anticipated uncertainties, the expected reduction in this dispersion by interdepartmental and intertemporal pooling, the percentage of owned equity in the participating firms, and the indifference toward relative certainty and relative efficiency of the majority of the participating entrepreneurs. To the extent that specific relationships are pooled, they

also will be shared among the groups of participating firms involved on the basis of anticipated proportionality.

C. Participating Firm Profit Maximization

Following the orthodox static assumptions, the cooperating firms individually seek to maximize their profits, considering the part of their operations in the jointly operated plant as well as their individual operations outside of it. Two conditions are necessary in order to accomplish this objective. In the first place each participating firm must be in production equilibrium. Secondly the joint plant must be of optimum size. Although these two criteria are related, it is possible to satisfy either one without satisfying the other. The profits of the participating firms are not at their absolute maximum unless both are met.

The necessary equilibrium conditions are the same as those for any firm. The best combination of outputs will be produced at the least cost combination when the ratio of the marginal expenditure to the marginal revenue productivity is equal for all inputs in the production of all outputs within the firm. The optimum firm size will be defined at the point which equates the marginal revenue with the marginal cost of each product produced and for all products taken together. These conditions together mean that the marginal revenue productivity must equal the marginal expenditure for each

input in all alternative uses within the firm.

The participating firms are ordinarily vertically integrated in the sense that the output of the joint plant is the raw product input of the individual plants of the participating firms, or alternatively the output of the individual plants of the participating firms is the raw product input of the joint plant.[1] As products move from one plant to another in a vertically integrated firm, their ownership does not change and no price is established for them. Such a firm is not interested in the profitability of any one of its plants considered alone, but rather in the profitability of the complete chain of integrated plants operating as a unit. The optimum output is determined on the basis of the complete operation and, if measured in comparable units, will be the same for each of the plants. The vertically integrated firm determines this optimum output by equating the sum of the marginal cost functions in all plants with the marginal revenue in the final plant from which the product is marketed.[2] The cooperating firm equates

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[1]The exception is the plant operated jointly by two or more firms to procure specific capital resources, such as farm machinery for agricultural firms. In this case each participating entrepreneur will equate the marginal cost in the joint plant with the marginal revenue productivity of the resource in his individual plant. Such participating firms are also integrated in the sense that several stages in the production process are brought under one entrepreneurial control. The more narrow definition of vertical integration used in the text is necessary, however, for analytical purposes.

[2]Cf. Hirsch. op. cit. p. 97-144.

the sum of the marginal cost in its individual plant or plants and the marginal cost in the joint plant with the marginal revenue from whichever of the two the product is marketed.

The relevant segment of the marginal cost function in the joint plant to each participating entrepreneur is that beginning with the sum of the equilibrium outputs of all other participating entrepreneurs rather than at zero output. Each entrepreneur must consider the additional costs in the joint plant resulting from his volume of output. The precise equilibrium output of any one participating firm cannot be determined unless the equilibrium output for all others is given, because without this information the exact segment of the marginal cost function which is relevant cannot be determined.[1] Formal solution of the optimum output for each participating firm and the joint plant, given the number of participating firms, is possible by simultaneous equations only. If the output product of the participating firms is marketed from their joint plant, everything which has been said about the relevant range of the joint plant marginal cost curve to each firm is true also of the relevant range of the marginal revenue curve.

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[1]This is not true if the marginal cost function is horizontal over the relevant range.

Aside from variations due to the adjustment to optimum output in each firm, the size of the joint plant is determined by the number and size of the participating firms. Aside from any expected opportunity to influence the relevant markets, the economic motivation for cooperation among sovereign firms is a decreasing long run average cost curve over a considerable range for a part of the total economic function, or contemplated function, of the several firms.[1] By pooling this part of their activities and functioning coordinately through a common plant, they are able, under these conditions, to increase their economic efficiency by approaching more nearly optimum size for this operation. Once several firms agree to set up and operate a plant jointly, they are interested in obtaining the size in their joint plant which will maximize plant efficiency and make the greatest possible contribution to the profits of each participating firm. When the optimum size for the joint plant has been determined, adjustment to this optimum is made over the long run by varying the number of participating firms. Plant size is reduced by failure to replace firms that retire from participation and expanded by encouraging new firms to participate.

How is the optimum size for the joint plant determined? The joint plant will be of optimum size when the average net

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[1]Under dynamic assumptions, the opportunity to pool uncertainties is a motivating force. This is discussed in section D below.

return from the plant is at a maximum because the greatest contribution of the plant to the profit of each participating firm, regardless of the size of the firm, will be at this point.[1] Where the output of the joint plant is raw product or specific resource input for the individual plants of the participating firms, optimum size in the joint plant is defined by the minimum point in the long run average cost function in the joint plant. This cost function includes both the costs of factor inputs and the costs of the raw product inputs and is comparable to the long run average cost function in an individual firm performing the same function as that performed in the joint plant. Since the participating firms operate the joint plant to supply their individual plants and therefore face no revenue function from their joint plant, optimum plant size will not be the same as the optimum size for such an individual firm, however, unless the demand curve for output facing the firm is perfectly elastic.

Where the output of the individual plants of the participating firms is the raw product input of the joint plant, the optimum size for the joint plant is defined at the output which maximizes the vertical distance between the long run average revenue curve and the long run average cost curve in

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[1] Cf. Phillips. op. cit., p. 72-84.

the joint plant. The plant long run average cost function in this case is net of the cost of raw product inputs supplied from the individual plants of the participating firms. Again the optimum size for the joint plant will not necessarily be at the same output as the optimum size for an independent firm in the same environment unless the demand curve for output and also the supply curve for the raw product input for the firm are perfectly elastic.

If the production carried on by the participating firms makes it economic and the long run per unit joint cost decreases with volume in the joint plant, the participating firms will all maximize their profits by adding departments in the joint plant, each of optimum size, until a size is reached which minimizes the long run per unit joint cost. The determination of the optimum size in the joint plant is distinct from the determination of the optimum size for each participating firm. Optimum joint plant size is achieved by varying the number of participating firms, each of optimum size. Both optimums must be reached if the profits of each participating firm are to be an absolute maximum.

D. Dynamic Considerations

Under dynamic conditions the participating firm is interested not only in the maximum expected discounted value of the profit stream, but also in the minimum expected variation

in this stream over time. For each entrepreneur in any given planning period, there conceivably must be some optimum balance between these two objectives. The necessary conditions for the maximum discounted expected profit stream for the firm in any period are similar to those under static conditions. The firm will produce the best combination of outputs at the least cost combination when the ratio of the discounted expected marginal expenditure to the discounted expected marginal revenue productivity is equal for all inputs in all alternative uses within the firm.[1] The optimum planned output in each period is defined by the intersection of the expected discounted marginal cost curve and the expected discounted marginal revenue function. The sufficient conditions must provide that anytime the firm is thrown out of equilibrium, adjustments to again meet the necessary conditions will cause conversion to the efficiency equilibrium.[2]

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[1]Provided the ME and MRP functions are so defined as to include intertemporal relationships. The same input or output in different time periods is considered as separate inputs and outputs. The anticipations are adjusted for uncertainty premiums and discounts. Cf. the following:

Hicks. op. cit., p. 192-226.

Carlson. op. cit., p. 103-126.

Lange. Price Flexibility. . . . op. cit., p. 20-44.

Hart. op. cit.

[2]Samuelson. Foundations. . . . op. cit., p. 257-349.

In order to be in equilibrium under the objective of maximum stability of the profit stream over time, the participating firm must allocate resources and plan production so that the expected marginal gain in stability over time is equal to the expected marginal cost of the organization for stability. The ratio of the expected marginal gain in stability to the expected marginal expenditure of organizing for stability must be equal for all methods used by the firm to achieve profit stability over time. This equilibrium must also be stable in the sense that if the firm is thrown out of equilibrium, adjustments to again meet the necessary conditions will cause conversion to the stability equilibrium.

Given the production plan which maximizes the discounted value of the expected stream of profits and the production plan which minimizes the expected dispersion around the most probable profits over time for a participating firm, the task is resolved into the selection of the best compromise position between the two. The location of this compromise position for a given firm will depend upon the "technical" relationship between these two objectives and the indifference map of the entrepreneur defining the relative importance of the two objectives to him. If both the technical relationship and the indifference map are assumed to be definite and clearly defined and without discontinuities, a unique optimum position will be described by the point of tangency of the technical relationship function and an indifference curve between these

two objectives. The only rational segment of the technical relationship function is that part where the two objectives are competitive, because the entrepreneur can improve his position by moving into this range regardless of the slope and shape of his indifference curves toward the two.

The conditions for optimum efficiency in the firm participating in a joint plant pointed out in the previous section are applicable under dynamic conditions if discounted anticipated variables, including allowances for uncertainties, are substituted for given ones, and, if intertemporal relationships between variables are provided for. What about the conditions for optimum stability in the participating firm? First of all, as long as it is economic, the anticipated conflict of interest among participating entrepreneurs must be minimized. This means an association of reasonable homogeneous rather than heterogeneous participating firms. Specification of the conditions of participation in the articles and bylaws of the association will also help to minimize this anticipated conflict of interest. It will also cause each entrepreneur to face less uncertainty as to the continued participation of the other firms.

Secondly, aside from this uncertainty as to the attitudes and actions of the other entrepreneurs, participation in the joint activity in itself tends to reduce the anticipated variability of the profits of each firm over time. Vertical integration, by reducing the number of markets of concern to

the participating entrepreneur, makes the profits of his firm more stable under fluctuating market conditions. Also because of the higher degree of coordination of the various processes, the vertically integrated operation will ordinarily be more adaptable to changing technical and economic conditions facing the firm. The participating firms may gain further stability by diversifying horizontally and laterally both in the joint plant and in their individual plants. Where there are several departments in the joint plant, all of which are integrated with the individual activities of the participating firms, anticipated stability is usually greater than would otherwise be the case. This is particularly true where counter-cyclic fluctuations are expected among the activities and outputs of the participating firms. The opportunity to pool uncertainties within the group of participating entrepreneurs is another source of increased anticipated stability of profits over time to each firm. It will often be economic, because of the gain in anticipated stability, to pool uncertainties of the joint plant operation which are specific to a given department or time period between departments and over time. All such increases in the anticipated stability of profits to the participating firms over time result directly from the fact that they have carried out "concerted integration".[1]

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[1] See Robertson, D. H. The Control of Industry. Harcourt, Brace and Co. New York. 1923. p. 49.

Participation in the joint plant often reduces capital-rationing and other market imperfections facing the firm. Consider capital-rationing as an example. Participating firms are usually able to obtain credit as a group for the joint activity as such, even though some of them individually are unwilling or unable to obtain the use of any more capital. The structure provides machinery whereby participating firms with a high marginal productivity for capital may borrow from those with a low marginal productivity for capital. Firms are willing to borrow more capital because they jointly assume the anticipated added uncertainties arising from the additional borrowed capital and expanded production activities. The chief result of the reductions in capital-rationing and other market imperfections is that they provide for an increase in expected economic efficiency for each participating firm without a corresponding decrease in the expected profit variability over time, and vice versa.

E. Practical Considerations

The concept of the basic economic structure of the cooperative association and the interfirm relationships resulting from the joint ownership and operation of a common plant should provide an important working tool to the applied economist, the cooperative attorney, the cooperative accountant, the practical cooperative leader, and the law maker alike.

It should avoid the insurmountable difficulties and inconsistencies which arise when the cooperative is looked upon as a firm and its operation studied apart from the individual operations of the participating firms. Only a few examples are given here to illustrate the application of this basic concept to problems of cooperative policy.

What is the legal structure for cooperative associations consistent with their basic economic nature? In the United States and in many other countries the cooperative association is legally a corporation with certain special provisions to conform to the "cooperative principles". In some countries, Holland and the Scandinavian countries for example, the cooperative is legally a partnership. Neither of these adequately recognize the basic economic nature of the cooperative. The cooperating firms should legally be allowed to "associate". Their joint activity should be given legal recognition by providing "articles of association" to the participating firms. The joint plant should legally be recognized as an integrated part of each participating firm.

The articles of association should provide adjustments to differences in the marginal productivity of capital among the participating firms. They should make provision for the joint plant to continue in operation as a business unit over time as old participating firms withdraw and new ones come into the association. They should not provide the corporate limited liability, but should make each participating firm

proportionately liable for the joint activity as a firm, not just to the extent of its capital allocated to the joint plant. Each firm should be proportionately liable only, however, rather than be individually liable for the entire joint activity as in a partnership.

A legal form consistent with the basic economic nature of the cooperative association must give recognition to the fact that separate economic units carry on a part of their total economic activities jointly and coordinately in a common plant. It must provide for this associated activity without divorcing it from the separate activities of the participating firms. It must provide for equitable participation in all economic relationships incident to the joint activity by each participating firm, and give each entrepreneur reason to believe the other participating entrepreneurs will also participate equitably in these relationships. It must provide independence to each participating entrepreneur relative to his individual activities which are vertically integrated with the jointly conducted economic activity. And finally it must provide a framework which enables the participating entrepreneurs to operate the joint plant in their own best interests considering the entire vertically integrated activity of each participating firm.

On the basis of the economic nature of the cooperative association, what can be said about federal income tax policies toward cooperatives? If tax policies levied on

business units were consistently made, they would tax the profit income of the economic firm to the firm, regardless of the legal nature of the firm. The tax would be levied on the firm as a business unit, and any earnings taxed to the firm and distributed to stockholders or other individuals would not be taxed again in the hands of these individuals. Only under such an income tax policy can the income of the participating firms in a cooperative association be realistically taxed.[1]

To be accurate and consistent, the tax must be levied against the participating firms individually on the total net profits of each. No profit is made in the joint activity as such any more than in any other economic plant. The plant is operated as the part of its parent firm--in this case its several parent firms--with the expectation of increasing the profits of the firm. In a given short run situation, profits to the parent firm may be maximized by operating one plant at an accounting loss. It is impossible to determine any actual profit or loss[2] in any single plant of an integrated firm because goods and resources moving from one plant to another within the firm do not change title and no price is established for them. The entrepreneur of each participating firm

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[1]Elimination of income taxes on business units altogether and at the same time eliminating "loopholes" in personal income tax regulations would accomplish the same purpose, and is likely to be more satisfactory from the "ability to pay" standpoint.

[2]As distinguished from an accounting "profit" or "loss".

operates his entire integrated firm, including that part in the joint plant, so as to maximize his anticipated profits in the firm. Realized profits can accurately and realistically be taxed only to the several individual firms participating in the cooperative association.

The present income taxation of business units in the United States is based entirely on the legal nature of these units rather than in their economic nature. Since legally the cooperative association is usually a corporation, it is taxed like the corporate firm, except for certain qualified farmer cooperatives, which are exempt from corporate income taxes except on earnings which are not allocated to participating firms. The cooperative which makes prior contractual arrangements to make patronage refunds does not pay corporate income tax on these refunds when allocated to its patrons. Legally such refunds are not constructive income to the cooperative association. The present income taxation of cooperatives is based entirely on legal considerations, so that the explanation of the present income tax policies with respect to business units is principally a legal matter.

All that can really be said, from the point of view of the economic nature of the cooperative association, is that the legal concept of patronage refunds and their income tax status corresponds to their true economic nature. From the standpoint of the economic nature of the cooperative association the "purchase and sale" is simply one convenient

practical way of operating the joint plant. The "price" at the time goods move from the joint plant to the individual plants of the participating firms, and vice versa, is no economic price at all, but only tentative settlement. Patronage refunds, and they could conceivably be negative as well as positive, are the means by which final settlement is made under this method of operation after the total per unit costs of operating the joint plant have been determined and are charged proportionately to the participating firms.

Non-member business in the cooperative association is another widely discussed issue. According to Emelianoff, ". . .business transacted with outsiders is the basic factor of the degeneration of cooperative aggregates through pseudo-cooperative forms into collective enterprises."[1] Dr. Nourse, however, has taken the position that "as a matter of practical expediency, it does appear to be important that cooperative associations should not be prevented from handling the product of non-members under any and all circumstances."[2] Is there anything in the basic economic nature of the cooperative association which is counter to non-member business? When non-member business is transacted in order to <u>reduce</u> per unit <u>costs</u> in the <u>joint activity</u> and thereby make the several <u>firms</u> of the participating entrepreneurs more efficient, such

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[1] Emelianoff. op. cit., p. 230.

[2] Nourse. Legal Status. . . . p. 255.

action is consistent with the joint plant concept and the objectives of the participating firms. On the other hand, if the non-member business is motivated by anticipated profits in the joint plant as such from this business, without regard to the effect of the non-member business on the efficiency of the participating firms, the economic nature and purpose of the cooperative association has been disregarded.

In cases where operating efficiency may be increased by adding volume in the joint plant, the member firms will gain this efficiency most economically by inducing additional firms to participate, because, since the new firms will allocate resources to the joint activity, the added efficiency comes without additional outlay as far as the previous group is concerned. However, it may not always be possible to do this. If not, it may be economic to transact business with non-member firms--firms to which it is currently uneconomic to participate in the joint plant. Ordinarily such non-member business will represent a small percentage of the total volume in the joint plant. The economic status of non-member patrons, other than subscribers, as far as the joint plant is concerned, is that of third party. The production activities of the non-participating firm is in no way integrated with the joint activity. Such firms have entered into none of the multilaterial economic relationships which exist among the participating firms. They transact business <u>with</u> the joint plant, or actually with the participating firms, not <u>through</u> the joint

plant as do the member firms.

When non-member business is carried out only to the extent that it is motivated by the opportunity to increase the operating efficiency or operating stability of the participating firms, and represents a second choice to securing new participating firms in the joint activity, it is consistent with the basic economic nature and purpose of the cooperative association.

These three brief examples may serve to point out the usefulness of the concept of the basic economic nature of the cooperative association. Many others could be cited. An understanding of the concept as developed here clearly reveals the absence of scientific basis for such statements as "in the cooperative association people not capital count", "factories are free to cooperative members", "cooperation is a superior way of doing business", "to the extent that the cooperative is different from other types of business activity, it is a social organization" and "in business, cooperation is the antithesis of competition". Such so called "cooperative principles" as "business with members at market prices" and "one-man one-vote", "business on a strictly cash basis" are revealed as inaccurate or irrelevant. And finally the concept can contribute much toward improved financial structures, improved accounting procedures, and better policy decisions within cooperative association, and aid in the formulation of sound public policies as they relate to cooperative activity.

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